

DEPARTMENT OF DEFENSE ECOSYSTEM MANAGEMENT POLICY EVALUATION

**Edited by John Fittipaldi and John Wuichet
August 2002**

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The views expressed in this paper are those of the authors and do not necessarily reflect the official policy or position of the U.S. government, the Department of Defense, or any of its agencies.

Army Environmental Policy Institute
101 Marietta Street, Suite 3120
Atlanta, Georgia 30303-2711

ABSTRACT

DoD announced the implementation of an ecosystem management approach for the management of installation lands in a 1994 Policy Memorandum from the Office of the Under Secretary of Defense (OUSD). The installation Integrated Natural Resources Management Plan (INRMP) is the tool for implementing ecosystem management. To date, there has been no retrospective review across DoD of implementation of ecosystem management. The Legacy Resource Management Program and Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health (DASA(ESOH)) supported the Army Environmental Policy Institute (AEPI) in studying ecosystem management implementation and providing recommendations for improvement strategies and adjustments to current DoD ecosystem management policy and Service guidance.

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EXECUTIVE SUMMARY

The Department of Defense (DoD) identified ecosystem management as its land and water management approach of choice in the mid-1990s. However, until now no retrospective study has been conducted to determine how effectively ecosystem management policy is implemented.

The goal of this study is to provide insights into the level of ecosystem management implemented across the military Services. Objectives included performing a policy gap analysis of the individual military Services' conservation guidance and regulations to determine if they carry through the requirements set out by DoD Instruction, *Environmental Conservation Program* (DoDI 4715.3), developing a protocol to evaluate ecosystem management implementation, and applying this procedure through case study.

After researching evaluation methods, it was determined that the study would use what is termed a multiple case version of the classic single case study. DoD's ten Principles of Ecosystem Management (DoDI 4715.3) provided the basis for interview questions used at each installation visit (i.e., case study). Two cases study per Service were conducted to give eight case studies. A policy gap analysis of the Services' natural resources regulations and guidance was used as a basis for evaluating ecosystem management.

The gap analysis found that for several key areas guidance is lacking across all the Services.

- Information or sufficient detail was lacking on (1) ecosystem management, (2) inventorying, (3) monitoring, (4) adaptive management, and (5) partnerships.
- The subsequent case study analyses found these same key areas problematic or unclear to the installation natural resources managers.

Some technical aspects of ecosystem management are poorly understood and this can become an impediment to successful implementation of ecosystem management.

- DoD ecosystem management policy is not reflected in Service-level policy and implementation guidance
- Organizational issues impede adoption of ecosystem management principles. Ecosystem management implementation requires more authority than that given to the resource managers, who are far removed from the commander and are low in the installation organizational structure.
- Ecosystem management is incorrectly viewed as a separate activity requiring its own line item in natural resources budgets. Funding non-compliance related ecosystem management projects is difficult and this hinders effective implementation.

- An adequate number of staff trained in ecosystem management principles is lacking. In general, natural resources staff is few and in many cases consists of only one natural resources manager. With the breadth of responsibility needed for ecosystem management, lack of staff can directly limit implementation.
- Low organizational status of natural resource managers impedes effective communication with others on the installation and in the region, and furthers reluctance among managers to partner with non-military entities in the region. Ineffective communication can also adversely impact implementation.

DoD can enhance readiness by employing ecosystem management to help enhance long-term quality of the natural resources entrusted to its care. To ensure that ecosystem management is fully implemented and integrated within the day-to-day operations of all military departments, the following policy recommendations are offered:

- Promulgate and disseminate Service-level policy and guidance.
- Raise Natural Resource (NR) Management Offices higher in the installation chain of command, and enhance Regional Environmental Offices' ability to support installation NR managers and connect them with others in the region.
- Move closer to the goal of the DoD Instruction, where ecosystem management principles become not just special projects isolated from the rest of an installation's environmental program, but rather where they form the basis of decisionmaking at the installation level. Require proposals for new or continuing special projects to demonstrate how they will accomplish or embody the ten principles in the Instruction, and require all INRMPs, as well as the projects proposed to implement them, to demonstrate how they will support the accomplishment of ecosystem management goals and objectives.
- Train staff and inform leaders at installations and Regional Environmental Offices on the principles of ecosystem management as described in the existing DoD Instruction and the recommended new Service-level policy and guidance.
- Empower natural resource managers with the authority to enter into agreements with other land managing entities in the region. Installation commanders may realize that delegation of authority is in fact an exercise in authority.

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ACRONYMS

AEPI	Army Environmental Policy Institute
AFB	Air Force base
BASH	Bird Air Strike Hazard
DASA(ESOH)	Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPTM	Directorate of Plans, Training, and Mobilization
DPW	Directorate of Public Works
EM	Ecosystem Management
EMD	Environmental Management Division
EMR	Environmental Restoration Division
ENRD	Environmental and Natural Resources Division
EPRM	Environmental Program Requirements Module
ESA	Endangered Species Act
FORSCOM	Forces Command
GIS	Geographic Information Systems
INRMP	Integrated Natural Resources Management Plan
ITAM	Integrated Training Area Management
LCTA	Land Condition Trend Analysis
LRAM	Land Rehabilitation and Maintenance
MCLB	Marine Corps Logistics Base (Barstow)
MOA	Memorandum of Agreement
NBVC	Naval Base Ventura County (Point Mugu)

NEPA	National Environmental Policy Act
NR	Natural resources
NREA	Natural Resources and Environmental Affairs
O&M	Operation and maintenance
OSD	Office of the Secretary of Defense
OUSD	Office of the Under Secretary of Defense
PAO	Public Affairs Office
RCW	Red-cockaded woodpecker
REO	Regional Environmental Office
SAIA	Sikes Act Improvement Act
SILO	Strategic Installation Learning Office
TM	Technical manual
TRADOC	Training and Doctrine Command
USFWS	U.S. Fish and Wildlife Service

1. Background

The Department of Defense (DoD) has a long history of natural resources management, which has changed over the years to keep pace with developments in that field. As the state of the science has evolved, legislation has supported improved practices and DoD and the individual Services have developed new guidance and regulations. Key support for ecosystem management appeared in the DoD memorandum on implementing ecosystem management (1994), the subsequent DoDI 4715.3, *Environmental Conservation Program* (1996), and the Sikes Act Improvement Act in 1997 (SAIA). DoDI 4715.3 provides guidance to the Services in implementing ecosystem management. It specifies that the tool for implementing ecosystem management is the installation Integrated Natural Resources Management Plan (INRMP), and the SAIA requires implementation of these plans. DoD's Principles of Ecosystem Management were first presented in the 1994 memorandum and subsequently in DoDI 4715.3, along with INRMP guidelines. A more detailed discussion of the individual Services' regulations and natural resources guidance is in the gap analysis in Appendix A.

Implementation of ecosystem management has been underway at DoD for almost ten years, but the extent of implementation has not been examined until now. Without this examination, subsequent policy expressions by senior leadership will lack a sound basis. The goal of this study is to provide insights into the level of ecosystem management implemented across the military Services. The objectives include performing a gap analysis of the individual military Services' conservation policy, regulations, and guidance to determine if they carry through the requirements set out by DoDI 4715.3; developing a protocol to evaluate ecosystem management implementation; and applying the protocol through case study.

After some research of evaluation methods, it was determined that the study would use what is termed a multiple-case version of the classic single case study (Yin 1994). The case study approach is qualitative and well suited to an evaluation of ecosystem management implementation. Such a qualitative study provides more detailed information than a purely quantitative analysis. Also, the intent was not to numerically rate installations or the Services. Such an activity would not provide any useful information and could be misinterpreted and consequently damaging to installation conservation programs.

2. A Case Study Approach

Case study research has a history of intense use and intense misuse (Tellis 1997). Although primarily used in the social sciences, the natural sciences are increasingly using the case study approach. There are both problems and benefits associated with this approach. A major criticism is that if the study depends on only one or a few cases, it is incapable of providing general conclusions (Tellis 1997). However, Yin (1993) and others argue that as long as each case study meets the specified objectives and goals, even a single case study can be acceptable. In support of the case study methodology, many researchers feel that it can uncover important information that is obscured when using a purely quantitative method (Tellis 1997). Also, case studies tend to be more flexible than other forms of research methods. Case studies can follow single or multiple-case designs. Multiple cases strengthen the results and increase confidence in those results (Tellis 1997).

According to Soy (1998), there are six general steps in a case study. These steps were applied to this evaluation.

- Determine and define the research questions (DoD's Principles of Ecosystem Management was the basic guidance document (DoDI 4715.3, Enclosure 6)).
- Select the cases (military installations) and determine data gathering and analysis techniques.
- Prepare to collect the data.
- Collect data in the field (site visits, interviews, installation document and information review).
- Evaluate and analyze the data (gap analysis, interviews, document review, internal and external review).
- Prepare the report (DoD Ecosystem Management Policy Evaluation).

Establishing the reliability and validity of a case study is essential. Ways to achieve this include developing a protocol and obtaining outside review of case study drafts (Yin 1994). The following sections discuss the protocol and outside review used in this study.

2.1 Protocol Used for the Study

The main goal of the study is to determine how fully the military Services (Army, Navy, Air Force, Marine Corps) are implementing ecosystem management. To achieve this goal the study used the following protocol:

- Perform a gap analysis of Service natural resources regulations, guidance, and guidelines (Appendix A).

- Develop forty questions to be used as discussion points for the case study interviews (Appendix B).
- Select eight military installations for the site visits and case studies.
- Conduct site visits to interview installation staff.
- Evaluate and analyze information.
- Assess the success of implementation of ecosystem management using the site visits, interviews, installation documents and information, and “existing knowledge.”

This study refers to the above bullets as the DoD Ecosystem Management Evaluation Package. The gap analysis (Appendix A) provides a basis for evaluating ecosystem management across the Services. The main finding of the gap analysis is that some key ecosystem management components are consistently lacking or are poorly addressed across the military Services’ guidance; specifically, descriptions of ecosystem management, monitoring, adaptive management, partnering, and inventorying. As reported in the gap analysis, the absence of or lack of reference to these key elements in the individual Services’ implementation regulations or guidance documents makes it difficult for natural resources managers in the field to have a clear understanding, frame of reference, or sense of direction about their individual Service’s intent for ecosystem management. This also leads to difficulties for the natural resources manager in seeking and securing funding and in gaining command support for projects and actions related to these key elements. It is not surprising that the case studies found these components problematic for managers when implementing ecosystem management (see section 3.1).

Forty interview discussion points/questions (Appendix B) were used at each installation to gather data for the evaluation. The questions are centered around DoD’s ten Principles of Ecosystem Management (DoDI 4715.3, Enclosure 6, 1996) and are intended to investigate the challenges to implementing ecosystem management that installations face. In addition, there were some initial queries to gain installation background information.

Interviews conducted at the eight installations typically spanned two days with the participation of two to eight installation staff. The study team conducting the interviews comprised two to four individuals. The number of installation staff participating in the interviews varied with the size and organizational structure of each installation — larger installations with more and larger programs tended to have more participants. Usually there were at least one or two installation points of contact involved throughout the entire interview and site visit, and other staff joined the interview as specific questions arose requiring their expertise and as staff schedules permitted. In general, all installation staff seemed enthusiastic about the interviews and were keen to participate.

The interviews included general discussion, discussion to address the interview questions, and a tour of the installation identifying key ecosystem management

practices. Interviewees received the interview discussion points in advance. The interviewees included natural resources, forestry, fish and wildlife, threatened and endangered species, and environmental managers but also military training and range management personnel whenever possible. The interviews were relatively informal and conducted in a group format. Some installation interviews followed the discussion points item by item, others were more a free-form discussion. In the latter case, the discussion points were reviewed before the close of the site visit to ensure that each topic had been addressed. Follow-up telephone conversations and email communications were conducted with all of the installations included in the site visits.

In addition to the interviews and site tours, relevant documents provided a source of information for the study. During the site visits, pertinent installation documents were available to the study team for review. The full variety of documents reviewed in support of this study came from more than the eight installations visited and included INRMPs, Environmental Assessments, Environmental Impact Statements, annual plans, master plans, installation organization charts, and various other installation documents (for example, range management, forest management, wildlife management, and erosion control plans).

The inclusion of particular installations in this study depended primarily on their nomination by each Service headquarters natural resources staff and on the willingness of the installation staff to participate. The chosen installations represent all the military Services (Army, Navy, Air Force, Marine Corps). The sites and a brief description are listed in table 2.1.

TABLE 2.1 LIST OF SITES CHOSEN FOR ECOSYSTEM MANAGEMENT EVALUATION PROJECT		
<i>Installation Name</i>	<i>Ecosystem Type (Bailey 1994)</i>	<i>Attributes</i>
Fort Stewart, Savannah, Georgia	Southeastern Conifer, Middle Atlantic Coastal Forests	Isolated site, high profile endangered species, combat training facility, ~280,000 acres
Tinker Air Force Base (AFB), Oklahoma City, Oklahoma	Central Forest Grassland Transition Zone	Primarily urban setting, no endangered species, maintenance facility, ~5,000 acres
Fort Knox, Kentucky	Eastern Broadleaf Forest Central U.S. Hardwoods	Numerous low profile endangered species, combat training facility, ~109,000 acres
Naval Base Ventura County (NBVC) Point Mugu,	California Coastal Chaparral Forest Shrub Province	Endangered and threatened species, air field and bombing facility, land (~4,600 acres) and sea

California		test range (~36,000 mi ²)
Marine Corps Logistics Base (MCLB) Barstow, California	American Semi-desert and Desert Province	Isolated site but ecosystem initiatives in Mojave Desert, high profile endangered species, logistics facility, ~5,000 acres
Marine Base Quantico, Virginia	Outer Coastal Plain Mixed Province	35 miles south of Washington, D.C. in Prince William County, Virginia, ~60,000 acres
Naval Submarine Base Kings Bay, Georgia	Outer Coastal Plain Mixed Forest Province	Among the newest installations in the US, construction starting in 1982; ~16,000 acres.
Robins Air Force Base, Georgia	Southeastern Mixed Forest Province	100 miles south of Atlanta, Georgia, spanning approximately 8,700 acres

As an internal check, a semi-quantitative evaluation was used to verify that the conclusions drawn overall and for each site were indeed based on the information gathered and the responses to the questions (Appendix C). This check evaluation grouped the responses to the discussion points according to whether they related to goals, strategies, or procedures. The data from each individual installation are not included as part of this study. To include them would imply that a purely quantitative approach was used to compare installations but this was neither the case nor the intent. To prevent attempts at such a quantitative comparison, the evaluation table in Appendix C presents average scores for all the installations visited. These scores display trends and support the analysis presented in this report.

Summary trip reports were prepared for each site visit (Appendix D). Analysis of the case study information is presented in this evaluation report and is also summarized under each of the individual case studies (Appendix E). The case studies discuss the issues from each installation relevant to ecosystem management implementation and highlight the successes and problems facing the individual installations. However, the information that is most relevant to the study is the review and analysis across the Services extrapolated from the eight representative installations and also from the other information sources. It was not the intent of this study to quantitatively evaluate individual sites. Rather the intent was to develop an overall picture of how ecosystem management is implemented across DoD, to identify any particular trends, and to propose appropriate policy intervention. The study team is aware of the limitations of generalizing across the Services but believes that the gap analysis and the evaluation of this representative group of installations do allow recurring DoD-wide issues to be brought to light.

2.2 External Review

The protocol, case studies, and the final report were reviewed to ensure and enhance the quality of the study. The case study participants reviewed their respective case

studies. Yin (1994) recommends having the subjects of the study review the case studies to assure their validity. To further ensure objectivity and quality of the study, Drs. Cheryl Contant and Bryan Norton of the Georgia Institute of Technology reviewed the protocol, final case studies, and final evaluation package.

3. Ecosystem Management Implementation Analysis across DoD

Site visits, interviews, and installation document reviews revealed common trends across the Services in the status of ecosystem management implementation. The issues or themes affecting successful ecosystem management are discussed and analyzed below. The issues can be considered common challenges or impediments that installations face when implementing ecosystem management. Overall, as the DoD's approach to land management, ecosystem management has a good start primarily due to the requirement that installations prepare INRMPs — DoD's tool for implementing ecosystem management. However, a similar set of issues hinders successful implementation of installation INRMPs across all the Services. As presented in this report, some of the issues are not new to natural resources managers or even to most installation staff.

3.1 Aspects of Ecosystem Management

The ten Principles of Ecosystem Management first appeared in a 1994 DoD memorandum and were subsequently published as principles and guidelines in an enclosure to DoDI 4715.3, *Environmental Conservation Program* (DoDI 1996). (The Principles are reprinted in Appendix B following the list of Case Study Discussion Points.) DoD's principles and guidelines address key components of ecosystem management that are generally acceptable to academicians and practitioners alike, and they provide guidance pertinent to installation managers. The principles and guidelines can be grouped into three key elements: goals, strategies, or procedures. DoDI 4715.3 also provides a DoD definition of ecosystem management as "A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural process; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex changing requirements; and is realized through effective partnerships among private, local, State, tribal, and Federal interests" (DoDI 1996).

The ecosystem management policy states that installations should develop a shared vision of their local region. "All interested parties (Federal, State, tribal, and local governments, nongovernmental organizations, private organizations, and the public) should collaborate in developing a shared vision of what constitutes desirable future ecosystem conditions for the region of concern. Existing social and economic conditions should be factored into the vision, as well as methods by which all parties may contribute to the achievement of desirable ecosystem goals." Developing such a vision necessitates being cognizant of the installation's regional setting and working with surrounding land managers (Federal, State, private, etc.) to collaborate on developing a regional vision that considers ecological, economic, and social factors of the regional landscape. From this collaboration, the installation can then develop a set of goals and objectives that strives to achieve the regional vision and the installation mission.

Although such a regional vision is ideal, this study found many bases do not take a regional perspective to ecosystem management. Numerous reasons exist as to why — regional visions require partners, management endorsement, time, and money, all of which are limited on an installation. Partnerships involve two or more organizations or interests collaborating on a program, initiative, or some similar combined action. Some installation staff are not aware that DoD's ecosystem management policy requires a regional perspective. DoD and individual Service policies and guidance that address ecosystem management are not always well distributed throughout the Services. Even with these challenges, some installations realize the importance of a regional perspective and do approach management from a regional perspective, even if there is no locally agreed upon vision. In these cases, the natural resources managers have adopted a previously-developed or accepted regional vision (e.g., Tinker AFB) or they use historical information about local ecosystems (e.g., NBVC Point Mugu) to perform management with a regional perspective.

Some bases are unable to acquire partners that may help them develop a regional vision and associated management goals and objectives. Bases are often isolated on the landscape, although many are becoming less remote and less isolated because of the spread of urban and suburban development. The sheer size of larger installations can also make them somewhat isolated as they are self-contained, often fenced-off, and have historically looked inward rather than outward. Most installations contribute positively to their local communities by providing economic opportunities (employment, support services); allowing agricultural leasing, grazing, and/or timber harvest; or by allowing hunting, fishing, and other recreational opportunities. But beyond this, interaction between installations and their neighbors was neither expected nor conducted. This attitude has been difficult to change by both installations and the local communities, but it is getting more attention as encroachment becomes a significant issue. Some installations are taking actions to identify dedicated staff as liaison with the local communities but otherwise, natural resources managers undertake partnering and joint efforts on their own initiative and frequently at their own expense (time, effort, and money).

Fort Stewart, near coastal Georgia, is one such installation that can be regarded as somewhat isolated due to its relative size (over 279,000 acres). Although close to the Savannah and coastal resort area, rural farming and forestry surround most of the installation. . As such there is little interest, and perhaps little perceived need, by the local community to develop a regional vision for land management. As a result, Fort Stewart lacks regional partners for ecosystem management. Fort Stewart is an active and significant contributor to the red-cockaded woodpecker¹ recovery program and contributes significantly to this initiative; however, the Endangered Species Act drives this initiative rather than an independent local or regional initiative.

¹ The red-cockaded woodpecker, *Picoides borealis*, is listed as an endangered species and is protected under the Endangered Species Act (ESA) of 1977, as amended. Military installations with known federally listed threatened or endangered species are required by the ESA to manage for the recovery of the species.

Installations in highly developed areas often face an equally difficult task when trying to develop a vision for the installation and establish appropriate goals and objectives. For example, Tinker AFB acknowledges the importance of regional ecosystem management but is limited by its surroundings — urban and suburban development that has all but eliminated the natural prairie grasslands. Despite this, the natural resources manager at Tinker AFB has developed a vision for the installation that includes reestablishment of native prairie grasses, albeit on a limited scale. Development can also be in the form of intensive agriculture or forestry. For example, crop farms surround most of NBVC Point Mugu and there is little interest in the development of a regional vision.

Partnerships to create a regional vision require commitment and compromise, which in turn requires dedication of funds and staff. However, development of a vision for ecosystem management and development of the associated goals and objectives for realizing that vision are not high on the priority list of any installation budget. The requirement for each installation to have and implement an INRMP did provide some impetus to fund the drafting of the INRMP itself but many INRMPs lack a clear vision, and some do not include goals and objectives for ecosystem management. Even when there are clear, prioritized goals and objectives, there is usually little funding available to implement supporting projects unless they have a compliance component.

Across the various Services, it is more likely that an installation has developed goals and objectives for installation-based ecosystem management rather than a regional vision. Goals and objectives are critical to ecosystem management and it is imperative that they are documented in the INRMP. While this may seem basic, the authors' reviews of more than fifty INRMPs conclude that many installations lack clear ecosystem management goals and objectives. Clearly articulated goals and objectives in the INRMP allow responsible and interested parties to have a clear understanding of the installation's intent for ecosystem management.

In the absence of clear goals and objectives, adaptive management cannot be implemented. However, monitoring and adaptive management are also areas where there is a lack of guidance from DoD and the Services and a lack of understanding at the installation level. DoDI 4715.3 does not include a definition of adaptive management, nor does it define monitoring in the context of ecosystem management and adaptive management. Monitoring must be an integral part of ecosystem management so that progress is made toward the desired goals and objectives. Monitoring should be used to detect when progress is not being achieved and when adaptive management is needed to get a particular management action back on track. However, with the exception of compliance monitoring for threatened and endangered species or for water quality, installations do not usually conduct monitoring of natural resources or related environmental parameters. Most installation natural resources managers indicated their interest in developing a monitoring program; however, it was not clear how such a program would be funded. The priority for funding remains with Class I "must funds" and very few natural resource activities, including natural resources monitoring, are interpreted as compliance-related.

For a DoD definition for adaptive management, one can refer to *Conserving Biodiversity on Military Lands* (Leslie et al. 1996); however, it states that for the purposes of that handbook the terms ecosystem management and adaptive management are used interchangeably. This does not help the natural resources manager identify DoD's intentions regarding adaptive management. Most installation staff consider that they do practice adaptive management because they are adept at responding at short notice to needs and mission changes. This is not adaptive management and may be better termed reactive or ad hoc management. Adaptive management is a management decision process. As explained in Leslie et al. (1996), "Rather than prescribe a management scenario, the manager working in an adaptive fashion tests possible solutions to problems in a scientific, experimental way, complete with controls." To implement this, one has to develop a monitoring program to validate or reject a given solution. For a DoD perspective on the links between ecosystem management, monitoring, and adaptive management refer to the handbook, *Resources for INRMP Implementation: A Handbook For Natural Resources Managers* (Legacy 2001).

3.2 The Organizational Challenge

Today's installation natural resources manager is an integrator of diverse goals and objectives and the key implementer of ecosystem management. This greatly-expanded role involves potentially far-reaching responsibilities. In the ideal situation, the natural resources manager's role involves on- and off-post (local and regional) planning components; integration with on- and off-post plans, activities, and groups; development of long-term land management strategies; and implementation of activities. However, within the organizational structure of an installation, the natural resources program is typically low in the hierarchy. This low organizational status of the natural resources group is likely the result of its historical support role.

In the past, the natural resources staff had a narrowly focused support role such as directly managing forests for the contribution of forest products to the local and national economy (foresters), or managing fisheries and hunting activities to benefit the military and local communities (wildlife managers). This pursuit of isolated management objectives was outlined in a series of multi-service Technical Manuals (TM) developed in the early 1980s (TM 5-630 Land Management; TM 5-631 Natural Resources Forest Management; TM 5-633 Fish and Wildlife Management; and TM 5-635 Outdoor Recreation and Cultural Values). These individual guidance documents do not reflect the responsibilities of today's managers, who must have skills in these areas as well as in program administration. One can point to some improvement in the status of natural resources programs within an installation's organizational structure — ten to twenty years ago most installations did not have a recognizable natural resources program. In some cases the natural resources programs were under the Civil Engineering Department until the creation of separate Environmental Departments; however, their status has generally remained low.

During the case study interviews, the project team did not introduce any discussion points addressing the organizational structure of an installation, beyond how the installation is organized and where the natural resources program fits (see Case Study

Discussion Points, Appendix B.) However, the issue of the installation's organization as an impediment to effective management was raised during every case study site visit. In all cases, the natural resources staff voiced their concern and sometimes frustration at not being able to accomplish what they are charged to do because of their program's organizational status. Several interviewed staff expressed that ecosystem management implementation requires more authority than that given to the resource managers, who are far removed from the commander and are low in echelon.

This low echelon means that the natural resources managers, who are the staff primarily responsible for implementing ecosystem management, are not included in the necessary decision-making, planning, and operational meetings and activities, or they are brought in too late to these processes to be effective. Ecosystem management is a proactive approach to land management, but in many cases the natural resources managers must operate in a reactive (not adaptive) mode.

It was frequently reported that even when the natural resources program staff are included in installation meetings, they may not be allowed to actively participate in the meetings. Usually the environmental branch or division chief or others up the chain of command interact at these installation environmental meetings. Most environmental divisions house numerous program areas (NEPA, natural resources, waste management, compliance, pollution prevention, etc.) and the division chief may be hard pressed to accurately report and interact on behalf ecosystem management.

Another impediment related to an installation's organization is the difficulty natural resources managers may face in gaining access to certain areas of the installation. Natural resources managers must conduct or at least supervise ecosystem management activities throughout the entire base. However, in some cases the cantonment areas and ranges are off-limits to the natural resources managers and there are no qualified staff managing these areas from an ecosystem standpoint. This leads to large gaps in an installation's overall ecosystem management. Frequently, the cantonment area is managed by a contractor-operated grounds maintenance crew and there are usually few opportunities for the natural resources staff to influence the management activities (such as mowing schedules, establishment of low maintenance areas, use of native species, control of exotic species, irrigation schedules). In part because of the organizational structure of installations, the grounds maintenance crews are rarely supervised by an installation natural resources specialist, and the natural resources staff are usually not involved in either the development or award of the contracts for grounds maintenance services.

More critical than the need for supervision of cantonment areas is the need for natural resources support in managing the ranges and training lands — a breakdown in management of range and training areas will eventually impact range sustainability and mission readiness. Some installations have mechanisms in place to ensure that there is good coordination between range management and the natural resources staff. One such installation is Fort Stewart, Georgia, where the range and natural resources staff work together through a combination of daily coordination and participation in regularly scheduled meetings to discuss upcoming range activities and how range activities may

interact with endangered species compliance and INRMP projects. The range division's ITAM² staff includes a biologist and field technicians who coordinate ITAM and range support activities with the natural resources program. Another collaboration between the natural resources staff and range division at Fort Stewart is that they share and maintain a common Geographic Information Systems (GIS) database, with the different groups having responsibility for maintaining their designated data layers (range, fish and wildlife, threatened and endangered species, forestry). Despite this coordination between range and natural resources, there is still a sense that the organizational structure works directly against the natural resources staff's abilities to work to their maximum efficiency and effectiveness in fully implementing ecosystem management.

Unfortunately, not all installations have such open communication between the natural resources managers and the installation organizations they support. In a few instances, there are severe limitations placed on the natural resources staff concerning access to range and training areas for routine management activities. This not only impacts the implementation of INRMP projects but in some cases will eventually impact the sustainability of the ranges and mission readiness. With the increasing training demands placed on a decreasing number of installations, it is critical that the ranges, which often comprise the majority of an installation's acreage, are an integral part of the installation's ecosystem management. In some situations, however, management of the ranges and training areas is not yet integrated with installations' overall goals and objectives for ecosystem management. Limited access to training areas for routine natural resources management, combined with a lack of range management and restoration activities, will lead to degraded ranges. Considerable time and effort will be required to return such ranges to the point where installation ecosystem management goals and objectives are achievable.

In some cases, the natural resources program may not have access to areas under the control of installation tenant groups. This is usually not a significant problem as the tenant areas are typically of limited acreage and have few natural resources. Again, the relatively low status of the natural resources manager within the installation's structure frequently means that they have little influence over tenant activities that may impact the environment. The natural resources staff at Tinker AFB tackles this issue by adopting the role of advisor to the tenant groups as well as to other installation organizations. Their intent is to influence the tenants and the installation groups to use their own environmental funds to implement activities that are supportive of the installation's overall ecosystem management goals and objectives, or at a minimum, are not

² The U.S. Army Construction Engineering Research Laboratories (CERL) developed Integrated Training Area Management (ITAM) as a comprehensive land management approach for Army installations and it remains today a predominantly Army initiative. ITAM is funded from Army Headquarters (supervised by the Office of the Deputy Chief of Staff for Operations and Plans with resource allocation by the Directorate of Training) down through the major commands to the ITAM installations' range divisions. ITAM funding requirements are based on a categorization of the installations that ranges from I to IV, with category I installations having the most critical training mission and significant environmental sensitivity to missions. ITAM's four components include two that require close coordination and cooperation concerning INRMP implementation — Land Rehabilitation and Maintenance (LRAM), and Land Condition Trend Analysis (LCTA). The former is basically a land restoration program and the latter is a land condition monitoring program.

counterproductive to meeting the installation goals and objectives. Educating the tenants and installations organizations about implementation of the INRMP is key to their success as advisors.

A lack of authority goes along with the low organizational status of natural resources programs. This lack of authority can also impact the abilities of natural resources staff to work effectively, especially when coordinating for off-installation or for regional efforts. In some cases, a meeting with an installation neighbor may be impeded by the chain of command simply because of the number of levels that have to give approval. It is important that the natural resources manager has flexibility in interacting with neighbors and potential partners and most managers fully understand the necessary limitations when interacting with outside groups. However, inflexibility on the part of the installation chain of command hampers developing and maintaining positive interactions with neighbors.

Natural resources programs with high-profile endangered or threatened species are less hindered by the organizational status. Installation commanders are aware of endangered species management and compliance issues and of the public's interest in certain protected species. When there are high-profile endangered species on post, there is frequently more support for the program from command, and the higher public interest often heightens the overall awareness about natural resources management both on- and off-installation.

3.3 Funding

Funding limitations are not new to installation programs, including natural resources. However, ecosystem management is under-funded and cannot be effectively implemented. Many personnel consider ecosystem management an unfunded initiative, albeit an important policy. Support for INRMP implementation should come from installation operation and maintenance (O&M) funds. Installations that collect fees for hunting and fishing can supplement natural resources funding for fish and wildlife management using these funds once the costs of the fish and hunting programs have been met. Installations with reimbursable forestry programs can use net proceeds, although generally small, to support installation forest management after costs are met and state entitlements awarded. However, many installations do not collect hunting and fishing fees, and relatively few installations have a reimbursable forestry program. As a result, O&M funds are the primary means available to the natural resources manager to support ecosystem management. Although with limited military department application, installations with active ITAM programs can also provide some support to the installations' overall ecosystem management through the LRAM and LCTA components (see footnote 2). However, the year-to-year funding for ITAM is not under the control of the natural resources program and unless ITAM support for range management is identified as a compliance item (for example, ITAM is a mitigation requirement associated with NEPA compliance, such as the environmental assessment for the INRMP), ITAM may not be a reliable source of funding support for range management. Fort Knox has seen shortfalls in ITAM support for LRAM and LCTA over the past several years and there are insufficient O&M funds available to make up for this

shortfall. The result is that many ITAM projects are idle and the environmental staff is only able to address the most critical management needs.

The Environmental Program Requirements Module (EPRM) is the DoD standard and uniform tracking system³ and is intended to help environmental managers program, budget, and track environmental requirements. Environmental requirements, including projects and support for ecosystem management, are funded depending on the class of each requirement. Classes applicable to environmental projects range from Class I to Class III (Class 0 funding is for recurring costs such as personnel salaries and administrative costs, and others). The EPRM was originally developed as an aid to maintain compliance and it is still strongly driven by compliance requirements with most Class I (“must fund” current compliance) and some Class II (maintenance requirements) project requirements being funded. Ecosystem management projects, for the most part not perceived to be compliance related, fail to be designated above Class III (enhancement actions beyond compliance) and therefore fail to be funded. The natural resources managers must use creative means to gain O&M funds for ecosystem management initiatives, or must turn to alternative sources of funds, including non-DoD funding. However, frequently there are restrictions on either applying for alternative funds (federal agencies may not qualify) or receiving funds from alternative sources. Identifying and applying for alternative sources of funding to support INRMP implementation projects is time consuming and there is no guarantee of success, so most managers are careful to limit their efforts.

Installations with threatened and endangered species management requirements are more successful in having their budget requests funded because of the need to comply with the Endangered Species Act. Sometimes, management for a threatened or endangered species may benefit the broader installation goals and objectives for ecosystem management. In these cases, the natural resources managers usually try to spread the “benefits” of these somewhat reliable threatened and endangered species management funds to other non-compliance natural resources initiatives.

However, there are instances where endangered species management does not fulfill ecosystem management requirements and may in fact compete with management for other species or with ecosystem goals and objectives. The funding of compliance-driven threatened and endangered species management and the lack of funding for non-compliance related ecosystem management actions (i.e., they do not qualify as Class I, Class II or even Class III) can lead to very lopsided management. Ecosystem management requires a holistic approach to management but most threatened and endangered species management is still based on a species-specific approach and management at installations with high-profile threatened and endangered species tends to follow management for those species rather than ecosystem management.

³ The Environmental Program Requirements Module, developed by Defense Environmental Security Corporate Information Management, was intended to replace the current systems used by the different component services such as the Air Force WIMS A-106 module or the Marine Corps CompTRAK. Although initially designed to be an aid in maintaining compliance, DoD enhanced the EPRM system to assist overall management of environmental programs and for monitoring progress in environmental stewardship.

Many budget requests for natural resources management support are turned down year after year. Managers who continue to request funding levels greatly exceeding the dollar amounts that are approved each year are often looked upon unfavorably. Over time, natural resources managers may become discouraged and cease to request the actual budget needs. In other words, some installations do not budget for projects unless they know they will get funding. In the long term, this will significantly impact the ability to effectively implement ecosystem management because of diminishing returns — if funding requests are routinely reduced to match anticipated funding levels rather than reflecting true funding requirements, then the natural resources manager will find it more difficult each year to meet that year's needs and to substantiate any future requested increase in funding requirements. Most INRMPs reviewed as part of this study revealed that project prioritization and funding requirements are areas that are frequently not included in INRMPs. In general, natural resources managers are somewhat hesitant to include this level of detail in INRMPs because they understand that they may not be successful in securing funding for even high priority projects and this could reflect negatively on the natural resources program. In some cases, projects and management activities are left out of INRMPs because they are not likely to get funded or the INRMP has a better chance of getting approved and signed by command without these “un-fundable” projects. This again hinders ecosystem management since it is difficult to acquire funding for projects that are not identified in the INRMP.

3.4 Staff Support

Understaffing is a common problem for both installation environmental and natural resources programs. In several cases, a lack of sufficient staff was voiced as a more critical issue than a lack of funds and it appears that in some cases ecosystem management implementation is being limited due to understaffing.

Small installations (less than twenty thousand acres) may have only one installation natural resources manager or, depending upon the circumstances, there may be no on-post manager, with natural resources management conducted by a regional manager or a manager at the major command level. Some significantly large installations also may only have one natural resources manager. Although increasing installation size does not necessarily correlate to increasing staff requirements, in most cases one natural resources staff is not enough to carry out the extensive requirements of ecosystem management. Sound natural resources management is the basis of ecosystem management but comprehensive monitoring, adaptive management, data management, data analysis, application of new technologies, partnering/outreach, and a continuous refinement of goals and objectives are all critical components. Even if one individual is skilled in all these areas, that person would be hard pressed to meet these extensive responsibilities while still being able to respond to day-to-day demands.

Understaffed natural resources programs find they can respond to short-term initiatives and immediate demands, but longer term ecosystem management initiatives are conducted piecemeal and only as time permits. Today's installation managers must contend with far more administrative requirements and demands for their time than

previously, and many expressed concern that they were unable to spend sufficient time in the field or directly on their natural resources management responsibilities.

Many installations have undergone or anticipate they will soon undergo the Commercial Activities Program review (commonly referred to as the A-76 process after the Office of Management and Budget Circular A-76). The A-76 process can potentially impact all military civilian employees as the various installation programs are reviewed to determine which are appropriate to be contracted out as opposed to those that will remain as government civilian supported. There is a general opinion that merely the threat of the A-76 process decreases morale on installations. Even those installations that have, as the staff describe it, “survived the A-76 process” experience a decline in morale to some extent. Installation programs that survive A-76 basically do so by demonstrating that it is more economically sound to retain the program as a government civilian supported function than to contract out the operation of the program. To succeed in this typically means that programs must become streamlined and must operate more efficiently. In reality, this means that some staff will lose their jobs and remaining staff must take on added responsibilities, usually with no additional support or compensation. So even if a program “survives” the A-76 process, morale can remain low because staff are overworked and overwhelmed.

The greatest concern voiced by the natural resources managers about the A-76 review process was not concern about job security but concern about the impact outsourcing will have on the stewardship of installation lands. Ecosystem management requires long-term, regional scale thinking and management. Installation natural resources managers are highly dedicated professionals and they have concerns that contractor staff will not perform ecosystem management with such a vision. Typically, contractor staff do not stay in their positions as long as a full-time civilian personnel, and indeed, most installation support contracts may not even span the five years of the first INRMP let alone management actions spanning ten or more years. Contractor support staff may also lack the necessary savvy about the installation natural resources. Many natural resources and environmental managers interviewed during the case studies had been involved in installation management in excess of ten years, and these individuals are the keepers of a wealth of installation information that would be lost if their positions were outsourced. Another concern about staffing is the lack of qualified staff available for hire to support installation ecosystem management. Not only do today’s natural resources managers have to be proficient in a full range of ecosystem and natural resources management practices, they must also be proficient in the administrative aspects of land management and have a sound knowledge of installation operations. Recent university graduates may have strong academic credentials and have been trained in the principles of ecosystem management, but installation natural resources management requires considerable on-the-job training. Once trained, and with a few years of experience, these individuals are frequently sought after by other federal land management agencies. The relatively low salaries of installation natural resources staff, and the relatively limited career advancement opportunities at an installation, make it difficult for natural resources programs to retain young, talented individuals.

In most cases, the natural resources programs can supplement their staff by acquiring contractor services and contract support staff (e.g., field technicians, GIS support, laborers, equipment operators) to assist in project implementation. However, this is frequently not efficient because contractor support staff commonly have a high turnover rate due to the lack of job security and due to salary competitiveness between contractor firms. Although these staff may directly support the natural resources program, the natural resources manager has little impact on the working conditions of contractor-supplied staff because these staff ultimately report to their employer, the contractor firm. Effective natural resources management requires an in-depth knowledge of the installation's natural resources, its terrain, and the various restrictions and requirements that come with working on a military installation. Contractor support staff typically lack this detailed knowledge about the installation and require considerable training before they become proficient. A high turnover of contract staff makes it difficult for the natural resources manager to rely on this type of support for much more than basic field support or data management activities. Unless specific project components can be identified, contract support staff may not be able to provide the necessary broad vision and appreciation for implementing an ecosystem management approach.

3.5 Communication

Many degrees of internal (on-installation) and external (off-installation) communication exist at installations. Communication on installation natural resources programs ranges from little-to-no knowledge to full acceptance and respect for natural resources programs. MCLB Barstow's natural resources program, for example, has established strong lines of communication between the natural resources manager and the commander, range manager, and civilian and military personnel and their families. The presence of the federally listed threatened desert tortoise (*Gopherus agassizii*) and participation in regional partnerships for desert management are the drivers for this communication. The presence of a high-profile endangered species on an installation can facilitate education of base personnel and installation neighbors on the natural resources program, and this in turn can facilitate communication.

Much of the communication difficulties encountered by natural resources managers seem to stem from the program's placement in the installation structure (refer to section 3.2). The relatively small size of MCLB Barstow and its relatively simple organizational structure probably enhance its ability to maintain good internal communications. However, for large installations with extensive installation support programs, the natural resources program is well down the organizational structure and this makes communication difficult with other installation groups and programs. Most managers felt that a more elevated position in the installation hierarchy and one with some authority would improve communications both on and off installation. For most installations, improved communications would lead to more efficient natural resources programs that operate proactively and are able to interact with the appropriate levels of the installation hierarchy and provide timely support.

Increased communication authority for natural resources managers would also benefit installations. In some cases, the natural resources program does not have the authority to communicate directly with certain installation groups that may be affected by natural resources or that may have significant impacts on natural resources. This inability to communicate directly greatly inhibits effectiveness and can be counterproductive to having an educated and supportive installation command and community.

One would expect installation public affairs offices (PAOs) to be involved in supporting communications for ecosystem management; however none of the visited installations indicated they use PAO support to help with communications. With regards to ecosystem management, the title “public affairs office” is somewhat of a misnomer. Installation PAOs are the commanders’ representatives to the media and the public for installation events. The PAO is not intended as a proactive liaison with the general public — it relays specific information when needed and as directed by the commander. However, the PAO is in a prime position to support such a long-term and far-reaching initiative as ecosystem management. The PAO frequently has direct access to the commander and has ready access to the media. The PAO, working with the natural resources manager, could be a link to maintain continuity for INRMP implementation between commanders. However, for their part, public affairs staff receive no training on reporting or communicating environmental issues other than limited guidance on emergency response. If an installation’s public affairs staff are involved in supporting the natural resources program it is usually because of the personal interests of the staff rather than as a result of a directive from the commander or request from the natural resources program

3.6 Partnering

In almost all ecosystem management and land management guidance, partnering is identified as a key to success. Partnering with regional interest groups is identified as a means to develop a vision of ecosystem health for an installation, and also as a key to successful INRMP implementation. However, establishing and maintaining partners is not a priority for most installation natural resources managers. In general, partnering requires too much time and effort with little guarantee of success. As explained above under section 3.1, Aspects of Ecosystem Management, installations may be unable to develop partnerships due to their size and location.

Lack of time and lack of staff support can mean that natural resources managers are unable to take advantage of existing organizations and initiatives that could be the basis of a partnership. Approval by command to become an active partner is also often lacking. Installation command and even immediate environmental supervisors often fail to see the benefits of partnering. Command may not understand that partnering is a joint, consensus-building relationship — command may make unrealistic demands on the partners and this can adversely impact the development of positive relations that may be needed for successful ecosystem management.

Partners may also make unrealistic demands on installations — they may regard the installation as a deep pocket with extensive resources to be tapped. Some installations

indicated that when they have approached local groups there has been a sense of “what can the group get from the installation” rather than “what can be achieved jointly through a partnership.” These are typical issues that arise when developing partnerships, but natural resources managers are neither trained nor qualified to resolve these issues and they certainly do not have the time necessary to address such concerns.

Because of these difficulties, partnering as a means to aid ecosystem management at the installation level is used infrequently by natural resources managers. Installations do use the technical support of other federal and state agencies (for instance, the U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, state fish and wildlife divisions); however, these associations are usually not true partnerships. There is no sharing of common goals and there may be few mutual interests. In these cases, the association between the agency and the installation is limited to gaining a particular area of expertise or coordinating on a specific issue. Although it is difficult at the installation level to establish and maintain worthwhile partnerships, partnering is an important component of addressing the regional aspects of ecosystem management. Partnering should still be pursued but may be better achieved through regional DoD initiatives (e.g., major command, multi-service, multi-agency).

3.7 Short-Term Accomplishments Versus the Long-Term Vision

In general, the military does not recognize the value of a long-term vision such as that required for ecosystem management, and as a result there are no rewards for developing or following a long-term vision. Success is based on short-term accomplishments and installation commanders are judged on successes during their brief tenure at an installation. Most installations reported that their current commander has been in place for less than two years and that few will remain after two years. New commanders arriving at an installation have their own agendas and they usually concentrate their effort on high profile initiatives that can show demonstrated successes within their tenure as installation commander. However, ecosystem management implementation must proceed regardless of a commander’s interests and agenda — ecosystem management is an ongoing, long-term initiative that demands the support of each consecutive commander. It must be given support and be funded on a regular basis and must not be changed or derailed mid-stream. Programs and operations identified as having responsibilities to support INRMP implementation must also be supported and funded for the long term.

Installation commanders’ levels of interest in and understanding of ecosystem management vary greatly across the Services and within the Services. It is not clear whether this is a reflection of their overall training or a lack of training in environmental awareness and land management. Differences in attitude, understanding, and approach between consecutive installation commanders can lead to a roller-coaster ride for ecosystem management implementation. One installation commander may be very interested in the natural resources program and be a major supporter of ecosystem management. A subsequent commander may not be as interested and therefore

support and funding for ecosystem management initiatives may diminish under that commander.

4. Summary and Conclusions

The Office of the Secretary of Defense (OSD) can enhance readiness by employing ecosystem management to ensure the long-term quality of the natural resources entrusted to its care. To ensure that ecosystem management is fully implemented and integrated within the day-to-day operations of all military departments, DoD and the Services must:

- Promulgate and disseminate Service-level policy and guidance.
- Raise Natural Resource Management Offices higher in the installation chain of command, and enhance Regional Environmental Offices' (REO) ability to support installation managers and connect them with others in the region.
- Move closer to the goal of the DoD Instruction, where ecosystem management principles become not just special projects isolated from the rest of an installation's environmental program, but rather where they form the basis of all environmental decisionmaking at the installation level. Require proposals for new or continuing special projects to demonstrate how they will accomplish or embody the ten principles in the Instruction, and require all INRMPs, as well as the projects proposed to implement them, to demonstrate how they will support the accomplishment of ecosystem management goals and objectives.
- Train staff and leaders at installations and Regional Environmental Offices on the principles of ecosystem management as described in the existing DoD Instruction and the recommended new Service-level policy and guidance.
- Empower natural resource managers with the authority to enter into agreements with other land-managing entities in the region.

Leadership at all levels is crucial to turn these recommendations into successful outcomes. All of these improvements must be accomplished in a way that is measurable and cost-effective. If DoD and the Services implement these recommendations, they will be on their way toward a more sustainable achievement of the readiness mission.

5. Findings and Recommendations

5.1 Findings

From the foregoing analyses, a number of key findings emerged. The study team identified lack of Service-level policy and guidance as a key factor. Installation natural resources staff identified organizational structure, lack of funding, and difficulties in securing staff as among the most significant impediments to effective implementation.

Finding #1: DoD ecosystem management policy is not reflected in Service-level policy and implementation guidance. While DoD ecosystem management policy provides a sound basis for establishing ecosystem management principles, these principles have not become pervasive in Service-level documents of the military environmental programs. Service-level policies, regulations, and guidance simply do not reflect current DoD ecosystem management policy.

Most installations have completed their first INRMP and are embarking on plan implementation without the benefit of Service-level policy and guidance relating to ecosystem management. No single military Service has any advantage here, and the problems are common to all the Services and to installations large and small alike.

In particular, guidance is lacking most in the areas of preferred practices for monitoring, adaptive management, and how to work with stakeholders to develop a shared vision of ecosystem health for the installation and surrounding region. The lack of Service-level policy and guidance in part explains why ecosystem management principles and practices are unclear to many installation natural resources managers. Some installation staff indicated they do not have a clear understanding of DoD's overall intentions regarding ecosystem management and there is no Service guidance specifically addressing it. At the same time, natural resources managers are in most cases successfully applying their own best professional judgment and most do not feel the lack of guidance is a significant impediment. However, the lack of clear guidance is leading to a fragmented patchwork of ecosystem management interpretations across DoD. These conditions lead to at least two sub-findings:

- Installations surveyed have not partnered with regional stakeholders to establish a regional vision of ecosystem health. Although establishing a vision in partnership with regional stakeholders is one of DoD's ten ecosystem management principles, this has not been realized primarily because the DoD policy has not yet been established in Service-level policies and implementation guidance. Interestingly, some regional entities have succeeded in getting together and identifying other environmental opportunities on a regional scale, but these activities have been managed through other "stovepipes" and excluded from the full understanding of ecosystem management. For example, many major metropolitan areas have developed regional air quality management entities, and some states have created regional watershed management authorities, but the regional air groups are managed through compliance dollars

under air programs, and similarly for watershed management. These are examples of regional ecosystem management thinking, but often fail to be recognized or funded as such.

- Installation natural resources managers do not understand what adaptive management means. Ecosystem management is a process of continual reassessment to determine if management actions are leading to the intended goals and if they are meeting the intended objectives. Adaptive management supports that process through continual learning and application of knowledge gained so that management actions can be refined to keep progress towards goals and objectives on track. When asked about the relevance of adaptive management, installation environmental managers were bemused, saying it is impossible to work for a military environmental program without being skilled at adapting to last-minute budget cuts, new priorities, and other exogenous factors. But few if any understood the science-based intention of adaptive management that incorporates trial and error and experimentation in management decisions that must be made when incomplete scientific data is the best that is available.

Finding #2: Organizational issues impede adoption of ecosystem management principles. Staff at every installation visited expressed concern about organizational challenges, even though no organizational questions were included in the case study interview questionnaires. Resource managers stated across the board that the low status of the natural resources program prevents their efforts from being effective. Natural resource managers are low in the installation hierarchy, and implementation of ecosystem management projects requires approval through a chain of command that is unnecessarily long. As a result, partnering with other agencies and local landowners to achieve regional objectives requires coordination and approval from an impeding list of superior offices and decision makers, grinding many initiatives to a halt before they ever get started.

Finding #3: Ecosystem management is incorrectly viewed as a separate activity requiring its own line item in natural resources budgets. Many installation natural resource managers complained that they did not have adequate resources to fund ecosystem management initiatives because these initiatives compete for already scarce program management dollars. This view underscores the lack of understanding many resource managers possess about what ecosystem management is.

At some recent military conferences, participants often present status reports on various ecosystem management initiatives going on in different parts of the country, each funded by the DoD Legacy Resource Management Program or other earmarked funds as a special project or initiative. While these projects are important, conference organizers often neglected to introduce any discussion at all about how ecosystem management principles can be integrated into the day-to-day activities of all installation natural resource management programs. Similarly, there is seldom much discussion about the role of INRMPs in implementing ecosystem management (OSD policy), even at these special project sites. Ecosystem management will continue to languish as long

as the notion is perpetuated that it is some kind of special project that competes with other natural resource management requirements. *To the contrary, ecosystem management is a general management approach that should underlie and support all natural resource management funded initiatives.*

Among those installations attempting to persist in treating ecosystem management as a special project requiring special funding, many find that funding is hard to come by because when treated this way its priority for funding is very low. Failing to understand that ecosystem management is a general management philosophy rather than a special project, many installation staff interviewed said ecosystem management will never be fully funded as long as it must compete with compliance-driven budget requirements. Ecosystem management is not a compliance driven program, so under the current Class 0 through Class III budget designation the Services are hard pressed to even minimally support such special projects. Ecosystem management is usually rated a Class III concern, and even basic monitoring is not funded unless deemed compliance related.

Among installations attempting to fund ecosystem management as a special project, it is those installations lacking threatened and endangered species programs that have the most difficulty securing ecosystem management funding. The presence of a protected species can be used by some installations as a compliance-driven reason for funding an ecosystem management initiative. The irony emerges when one considers that ecosystem management is intended to be less reactive than traditional approaches, but it is only when the situation has degenerated to a compliance-oriented, reactive mode that funding is released. This approach works for installations with protected species compliance, but it is still reactive and still fails to integrate ecosystem management principles into the *entire* natural resources management program of the installation.

The Army's ITAM program can support ecosystem management implementation, but over-reliance on ITAM can impede the process if ITAM funding is withdrawn. In some cases this has happened, leaving managers to compete (usually unsuccessfully) for O&M funds. They would not have this problem if they understood ecosystem management as a general approach rather than a separate project.

The Legacy Resource Management Program was at one time a prodigious supporter of installation-level ecosystem management initiatives, but the program's budget is now very limited and is no longer able to support these interests. This is appropriate, since special projects were helpful in promoting the need for ecosystem-level thinking. However persisting in a "special project by special project" approach to ecosystem management will ensure its ultimate failure as an overall implementation strategy. DoD must move more assertively toward integrating ecosystem management principles into the overall effort to conserve natural resources on installations.

Ultimately, ecosystem management shouldn't be listed on installation natural resource management budgets as a separate line item. As a general implementation strategy,

ecosystem management principles should underlie all program activities, not just special initiatives.

Finding #4: An adequate number of staff trained in ecosystem management principles is lacking. Some installations may have sufficient funds but they are unable to get sufficient staff support for ecosystem management implementation. In many instances, there is only one natural resources manager for an entire installation with hundreds of thousands of acres to manage. The A-76 process and Reductions in Force have resulted in fewer staff remaining to accomplish an increased workload (although some may be unrelated to natural resources management). Even when funds are available to hire additional contractor staff support, natural resources managers in some parts of the country find it difficult to identify and retain qualified staff. New staff members require considerable training, and installations may suffer from a high staff turnover due to low pay and to limited opportunities for staff advancement. High staff turnover is an issue for both contractor support staff and for government civilian employees.

Finding #5: Low organizational status of natural resource managers impedes effective communication with others on the installation and in the region, and furthers a reluctance among managers to partner with non-military entities in the region.

Installation natural resources managers identified difficulties in internal communications and considered them to be a result of the low organizational status of their programs. Internally, they cited a lack of any consistent means or channels of communication to key offices and organizations. Externally, they described how ecosystem management requires active partnering with entities beyond the fence line, which is often confused with mere information dissemination by installation Public Affairs Offices (PAOs). Frustration mounts when these differences emerge, and as a result PAO is either seldom involved with ecosystem management activities to the degree that would be helpful to resource managers or is involved in a way that is not helpful.

Although partnering is strongly encouraged by DoD policy to assist in INRMP implementation, none of the installations visited are using partners to jointly establish a shared vision of ecosystem health, to set goals, or to assist with either INRMP preparation or implementation. Some installations said they made efforts in these areas and found the public was simply not interested. They speculated that perhaps it was because the installation lacked any “charismatic mega-fauna” protected species. In other locations the efforts never made it past the installation’s front gate due to a lack of installation command understanding, approval, and support.

5.2 Policy Recommendations

Recommendation #1: Promulgate and disseminate Service-level policy and guidance. Each Service should provide more direction to their installations on how the DoD ecosystem management principles are to be interpreted. The ten Principles outlined in DoDI 4715.3 are sound and are sufficient; however, Service-specific implementation guidance remains largely unavailable. Current Service regulations and guidance lack any detail on the ecosystem management concept and what it entails, and fail to explain

how ecosystem management principles are to be integrated into the day-to-day management activities through the INRMP.

Current DOD and Service leadership needs to embrace standing ecosystem management policy and emphasize that closer adherence to ecosystem management principals can proactively address concerns over the “encroachment” issue. It is through this renewed policy expression via interviews, speeches, and testimonies that the installation managers are provided the “policy cover” to take the necessary initiatives to implement ecosystem management.

Services should thoroughly disseminate their existing and new ecosystem management guidance to installations using a wide variety of tools. Successful institutionalization of ecosystem management by installations as the standard approach to land management requires an increase in education and awareness throughout the installation hierarchy, not just in the natural resources shop. The concept is equally critical to installation commanders, range managers, and environmental chiefs, since they must be cognizant and supportive of the integrated approach ecosystem management demands. Ecosystem management is not new to most natural resources managers but as an approach to land management, it is new to most other installation staff. The ten principles must become routine and institutionalized at the installation level.

Recommendation #2: Raise Natural Resource Management Offices higher in the installation chain of command, and enhance Regional Environmental Offices in their ability to support installation managers and connect them with others in the region. To better facilitate regional partnering, installation ecosystem managers must have enhanced access to installation leadership. In at least one installation (Fort Campbell, which was not a case study in this report), enhanced access was made possible through the creation of a Strategic Installation Learning Office (SILO). A number of environmental program management successes at Fort Campbell were attributed to the role of the community planner within the Fort Campbell SILO. Fort Campbell had shown commitment to protecting mission by supporting this position. The SILO planner’s location in the chain-of-command allowed him to inform and advise the garrison commander on regional land use planning issues, thereby overcoming an otherwise impossibly long chain of command between the natural resources manager and the garrison commander. The proactive approach led to Memorandums of Agreement (MOAs) with surrounding communities that will address regional land use planning issues.

Organizational change is difficult anywhere, especially in an entity as old and large as the military. But in this instance, a liaison at the REOs similar to the SILO at Campbell could help shorten the long chain of command between installation commander and natural resource manager. At some installations, such a liaison could provide direct links between installation programs and groups such as natural resources; range management; master planning; public works; public affairs; morale, welfare and recreation; and off-installation groups. The individual Services would determine which installations are considered key for the purpose of implementing ecosystem

management and which may benefit from establishing a liaison position. The liaison would have authority to interact directly with all installation programs and organizations and would be the key contact with partners and off-installation groups concerning land use and ecosystem management. It is important to note that this position should not be located with the office of Public Affairs. Rather, it should be filled by an installation land manager knowledgeable of the military mission and professionally trained in ecosystem management who can plan, interpret, integrate, and direct ecosystem management initiatives within and beyond the installation boundary. The liaison would also provide continuity from one installation commander to the next and would form the basis of seamless INRMP implementation.

An early draft of this report included a recommendation for creating a new position at every military installation called an installation ecosystem management liaison, which would report directly to the installation commander. The idea was that this new position would help gain greater visibility for ecosystem management by circumventing the long chain of command between the installation commander and the natural resources manager. However, it became clear that such a recommendation would require fiscal and human resources on such a large programmatic scale that it would be impossible to implement. Upon more careful consideration, this recommendation was removed in favor of suggesting a similar liaison at each of the REOs or the new IMA regional offices, thereby requiring only ten instead of hundreds of new staff, while at the same time focusing the ecosystem management at the regional level, where it ultimately belongs in the first place.

Since there are often multiple installations managed by multiple services in an ecological region, ecosystem management can be furthered dramatically by an enhanced role for ecosystem management within the existing DoD Regional Environmental Offices. Regional land management coordination conducted through the REOs could integrate various ecosystem management efforts being conducted by individual installations within given regions regardless of the military service to which they belong. Ultimately, each regional office should develop a regional land management plan that describes the roles and responsibilities of each military land parcel in the region and its avenues of interaction and cooperation with neighboring agencies and landowners. Each installation's INRMP would reflect its role in this larger, regional-scaled document that integrates ecosystem management into the broadest levels of the DoD's environmental management programs.

Recommendation #3: Move closer to the goal of the DoD Instruction, where ecosystem management principles become not just special projects isolated from the rest of an installation's environmental program, but rather where they form the basis of all environmental decision-making at the installation level. Require proposals for new or continuing special projects to demonstrate how they will accomplish or embody the ten principles in the Instruction, and require all INRMPs, as well as the projects proposed to implement them, to demonstrate how they will support the accomplishment of ecosystem management goals and objectives. Ecosystem management is a philosophical approach to land and water management, not a special initiative, and

therefore should require no specific funding mechanisms. The DoD Instruction establishes ecosystem management as official policy, with its ten principles clearly visible in all activities of the military environmental program. The Legacy Resources Management Program may have funded special ecosystem management initiatives in the past, but before the ecosystem management approach can be fully integrated into military programs it must be viewed not as a special project but as set of fundamental principles that underlie everything we do.

A proposed conservation, pollution prevention, or compliance project that does not demonstrate the principles of ecosystem management should be barred from receiving funding, even if the proposed action is categorized as a Class 0 or Class 1 initiative. To meet the terms of the DoD Instruction, all military environmental activities must incorporate the principles of ecosystem management at every turn.

Most installations have completed their first INRMPs and have requested funding already for the current 5-year Program Objective Memorandum. Starting with the next round of INRMP revisions and POM budget cycles, the ten ecosystem management principles should be included as “go/no-go” criteria for funding all installation environmental initiatives, including pollution prevention, compliance, and restoration projects. Similarly, these principles should be applied across all environmental media to include installation as well as regional air quality management partnerships, installation and regional watershed management efforts, and so on. If a proposed project or budget item fails to demonstrate how it will enhance ecosystem management on post, then it should be rejected for funding until it can be modified to support it. Doing so will ensure that installation natural resources are at a high enough level of quality indefinitely, thereby available indefinitely to sustain the training mission.

An earlier draft of this report recommended that creation of a “categorical exclusion” of sorts for ecosystem management projects in the Planning, Programming, and Budgeting systems of the services, thereby allowing these special projects to circumvent the typical Class 0 to Class III funding prioritization system that has traditionally hampered effective implementation of ecosystem management special projects. However, that earlier recommendation was later deemed inadequate because not only was it politically unlikely that such a circumvention could be effectively implemented, but also because it perpetuated the popular misconception that ecosystem management is some kind of special project and has nothing to do with the day-to-day management approach to total installation management. The revised recommendation better emphasizes the importance of making ecosystem management a measurable component of everything environmental that an installation does.

Recommendation #4: Train staff and leaders at installations and Regional Environmental Offices on the principles of ecosystem management as described in the new Service-level policy and guidance. Even with the “command and control” culture of the military, simply publishing a policy does not guarantee it will be adopted and implemented. The principles of ecosystem management and the ways in which ecosystem management can enhance readiness and sustainability must be

disseminated widely, beyond the natural resources manager to include installation and regional DoD leaders as well as soldiers and civilians in PAO, Judge Advocate General, Directorate of Engineering and Housing, and other elements of the garrison hierarchy.

One good source for ecosystem management-related information at the inter-service level is the Joint Stewardship Working Group (JSWG) of the Interagency Military Land Use Coordinating Committee (IMLUCC). The JSWG is currently focused on generating a handbook for installations on how to partner with others to manage withdrawn lands in support of the readiness mission.

Some regional offices are more advanced than others in their promotion of natural resources management at the regional level. In some regions, natural resources management is scarcely a program focus at all, but in others, it is an integral part of the regional office's mission. For example, the SE regional office is an active participant in the multi-agency Southeast Natural Resources Leadership Group, in the Southeast Ecological Framework Initiative, in the Fall Line Air Quality Study, and in an initiative to manage regional watersheds through an interagency partnership. All of these could be characterized as regional ecosystem management and should be encouraged across the range of DoD regional offices. The REOs meet monthly via teleconference and semiannually in person, providing opportunities to share the success stories from these activities and to further spread the idea that the Regional Offices can be a leading source of guidance in the implementation of regional ecosystem management among and between service installations.

Recommendation #5: Empower natural resource managers with the authority to enter into agreements with other land managing entities in the region. When hearing a call for better partnering with non-military entities to achieve military goals, many mistakenly assign related tasks to the nearest Public Affairs officer. The PAO is trained in dealing with the media to ensure that a unified message is disseminated to the public. But the information exchange needed to accomplish ecosystem management is not one-way, from the installation to the public. Regional partnerships for ecosystem management require working together to achieve a common vision of regional ecosystem health.

An example of the type of interaction needed is the recent initiative of U.S. Army-FORSCOM to develop Installation Sustainability Plans for each of its major installations. The plans include 25-year goals aimed at ensuring that environmental issues are managed in such a way over the long term as to ensure that the installation will be ecologically healthy enough to sustain training indefinitely. These goals are developed through a process that involves hundreds of stakeholders both on and off post, including state regulators, nonprofit advocacy groups, and private landowners sitting around the same table to develop goals that will minimize conflicts over increasingly scarce resources over the long haul, thereby helping to ensure the continued existence of the installation while on the path to sustainable regional growth.

Regional partnerships undertaken at the installation level can be complemented by parallel partnerships among regional stakeholders at the level of the DoD Regional Environmental Office.

REFERENCES

- Bailey, R. G., P. E. Avers, T. King, and W. H. McNab, eds. 1994. *Ecoregions and subregions of the United States (map)*. Washington, DC: USDA Forest Service. 1:7,500,000. With supplementary table of map unit descriptions, compiled and edited by W. H. McNab and R. G. Bailey.
- Department of Defense, DoDI 4715.2, *DoD Regional Environmental Coordination*, May 1996.
- Department of Defense Instruction 4715.3. 1996. *Environmental Conservation Program*, May. Available at <http://web7.whs.osd.mil/pdf/i47153p.pdf> or <https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Policy/note1.html>.
- Goodman, Sherri W. Deputy Under Secretary of Defense (Environmental Security). 1994. *Memorandum on Implementation of Ecosystem Management in the DoD*, 8 August. Available at <http://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Statements/note3.html>.
- Fittipaldi, J. J., and J. Wuichet. 1997. *Army Ecosystem Management Policy Study*, AEPI-IFP-397, Army Environmental Policy Institute, March.
- Legacy Resources Management Program. 2001. *Resources for INRMP Implementation: A Handbook For Natural Resources Management*.
- Leslie, M., G.K. Meffe, J.L. Hardesty, and D.L. Adams. 1996. *Conserving Biodiversity on Military Lands: A Handbook for Natural Resources Managers*. Arlington, VA: The Nature Conservancy.
- The Sikes Act Improvement Act of 1997. Public Law 105-85, Div. B Title XXIX, 18 November 1997; and codified at 10 U.S.C. §§670a *et seq.* (1998) (amending the Sikes Act of 1960, 10 U.S.C. §§670a *et seq.* (1996)). Available at <http://thomas.loc.gov/home/thomas2.html> or <http://www4.law.cornell.edu/uscode/16/670a.html>
- Soy, S.K. 1998. *The Case Study as a Research Method*. Available at: <http://fiat.gslis.utexas.edu/~ssoy/usesusers/1391d1b.htm>
- Tellis, W. 1997. Introduction to case study [68 paragraphs]. *The Qualitative Report*, July, [On-line serial], 3(2). Available at: <http://www.nova.edu/ssss/QR/QR3-2/tellis1.html>
- Yin, R. 1993. *Applications of Case Study Research*. , Beverly Hills, CA: Sage Publishing.

Yin, R. 1994. *Case Study Research, Designs and Methods*. Thousand Oaks, VA: Sage Publishing.

Appendix A: Gap Analysis

A. BACKGROUND

The Gap Analysis is a component of the evaluation of ecosystem management implementation on Department of Defense (DoD) lands. This gap analysis provides a baseline for the overall evaluation. The analysis focuses on “gaps” between DoD’s key ecosystem management instruction (1996) and memo (1994), and the individual services’ implementing regulations, guidance, and guidelines.

B. INTRODUCTION

On 8 August 1994, the DoD issued a memorandum stating that DoD would follow an ecosystem management approach for land use. The memorandum stated that ecosystem management (EM) should include: managing entire ecosystems; forming partnerships; seeking public involvement; using the best available scientific and field-tested information; and employing adaptive management techniques. The memorandum also states “ecosystem management will be achieved by developing and implementing integrated natural resources management plans (INRMP) and ensuring they remain current.” The memorandum requires that “Policy developed by the services must be consistent with the principles of ecosystem management....” An attachment to the memorandum defines ten Principles of Ecosystem Management.

Subsequently, DoD published DoD Instruction (DoDI) 4715.3, *Environmental Conservation Program* (1996). This DoDI draws from the 1994 memorandum and provides direction to all military services for implementing ecosystem management. Ecosystem management is defined in enclosure 3 of DoDI 4715.3 as “A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural process; is cognizant of nature’s timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex changing requirements; and is realized through effective partnerships among private, local, state, tribal, and Federal interests.” The instruction has eight enclosures including ecosystem management definitions (Enclosure 3), the ten Principles of Ecosystem Management (Enclosure 6), and General Contents of INRMPs (Enclosure 7).

Although initially presented in the 1994 memorandum and DoDI 4715.3, the requirement to prepare and implement INRMPs became law with the passage of the Sikes Act Improvement Act (SAIA) of 1997. Key changes to the Sikes Act as a result of the 1997 SAIA amendments include the following:

- Replacing the term “cooperative plan” with “integrated natural resources management plan.”
- Emphasizing natural resources versus “fish and wildlife.”

- Requiring both preparation and implementation of an INRMP.
- Requiring establishment of specific natural resources management goals, objectives, and time frames.
- Requiring regular review of the INRMP not less than every 5 years.
- Eliminating cost sharing and matching requirements of cooperative agreements.
- Allowing funds under cooperative agreements to be expended over an 18-month period as opposed to within a given fiscal year.
- Requiring that the public have an opportunity to comment on an installation INRMP.

The SAIA requires INRMP preparation and implementation but it has no specific reference to ecosystem management.

C. APPROACH

The study team identified sixteen elements from DoDI 4715.3 that they considered key to implementing ecosystem management. The elements were drawn from the natural resources section of the DoDI, the ten EM principles, and the general contents of an INRMP. These elements and the rationales for their significance are as follows.

1. General ecosystem management and the ten principles of ecosystem management — a definition and explanation of ecosystem management is critical if managers are going to successfully implement ecosystem management. Also, the ten principles specify the critical components of ecosystem management.
2. Critical definitions — ecosystem management conservation, biodiversity, INRMP, invasive species, and multiple use are important to understand in order to implement ecosystem management and are found in DoDI 4715.3 (Of equal importance are the terms adaptive management, baseline inventory, and monitoring but these are not currently defined in the DoDI.)
3. Manage ecosystems as opposed to individual species — this concept is a major paradigm shift and is central to ecosystem management.
4. Develop partnerships — stress the importance of partnerships on and off base and how they relate to performing ecosystem management.
5. Accommodate human use (i.e. multiple use) — ecosystem management requires consideration and integration of ecological, social, and economic issues.
6. Perform adaptive management (including monitoring and updating management procedures) — adaptive management is a component of EM that requires baseline inventories and monitoring.

7. The INRMP as a vehicle to develop and implement ecosystem management — it is important to explain the purpose of the INRMP.
8. Perform annual review and five-year revision of the INRMP — this is a requirement of DoDI 4715.3.
9. Maintain and restore native ecosystems — this supports the nation's policy on stewardship of federal lands.
10. Perform inventories — critical to ecosystem management and adaptive management.
11. Integrate INRMP with all installation plans — ecosystem management will be unsuccessful if integration is lacking.
12. The INRMP must present history and current status of natural resources — historic and current perspectives must be known to develop EM goals and objectives.
13. The INRMP must list all legal requirements pertinent to natural resources — must comply with the law (federal, state, and/or local).
14. The INRMP must present procedures and priorities for managing natural resources — successful implementation requires prioritization.
15. The INRMP should identify procedures for ongoing identification, maintenance, and enhancement of natural resources — this identifies ecosystem management and INRMP implementation as dynamic processes.
16. The INRMP should promote the beneficial use of natural resources — identifies that natural resources can be used in the public interest.

The services' natural resources regulations, guidance, and guidelines were reviewed to determine if these sixteen elements are addressed. The regulation, guidance, and guidelines reviewed included:

■ ARMY

- Army Regulation 200-3, Natural Resources—Land, Forest and Wildlife Management, 28 February 1995; and
- Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities, April 1997.

■ ARMY NATIONAL GUARD

- National Guard Bureau All States Letter (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000.

- **NAVY**
 - OPNAVINST 5090.1B, Chapter 22: Natural Resources Management, 9 September 1999; and
 - Guidelines for Preparing INRMPs for Navy Installations, September 1998.
- **AIR FORCE**
 - Air Force Instruction 32-7064, 1 August 1997.
- **MARINE CORPS**
 - Handbook for Preparing Integrated Natural Resources Management Plans for Marine Corps, November 1999; and
 - Marine Corps Order 5090.2A Environmental Compliance and Protection Manual, Chapter 11: Natural Resources Management Program, 1 July 1998.

The Air Force Instruction is currently under revision and the revised draft versions were not included in the gap analysis. However, based on a review of the revised draft DODI 4715.3, the team anticipates that the revisions would not significantly affect the gap analysis.

The individual service natural resource documents used in the gap analysis include instructions, regulations, guidance, and guidelines. While some are not strictly considered service policy (e.g., Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities), they do provide standard processes and formats for installation INRMP development and implementation.

D. FINDINGS

Although all the regulations, guidance, or guidelines contain some of the key elements drawn from DoDI 4715.3, none addresses all of these components. This can be explained in part for AR 200-3 because it predates the issuance of DoDI 4715.3. However, it was included in the gap analysis and was critiqued to determine if it captures some of the elements of ecosystem management. The gap analysis found five main elements lacking or insufficient in most guidance: (1) ecosystem management, (2) partnerships, (3) inventorying, (4) monitoring, and (5) adaptive management. The absence of or lack of reference to these key elements in the individual services' guidance makes it more difficult for natural resources managers in the field to seek and secure funding and command support for projects and actions related to these key elements.

Installation natural resources managers are required to implement ecosystem management. The lack of a frame of reference for ecosystem management puts installation natural resources managers in a position of having to guess (albeit best professional judgment) as to their service's overall intent for and support of ecosystem management. Ecosystem management is briefly mentioned in most of the guidance documents but they do not provide a definition of ecosystem management. There is no detail provided on ecosystem management and no information on how and why an ecosystem approach should be implemented.

Partnering, according to DoDI 4715.3, is considered “necessary to assess and manage ecosystems that cross political boundaries” and is included in the ecosystem management definition. However, across the services information on partnering is lacking.

The need for initial baseline inventories and use of inventories in overall adaptive management is another aspect of ecosystem management that cannot be overlooked but which is mentioned only briefly in the guidance/regulations. No information is provided on how to use inventories for ecosystem management. Inventories, sometimes referred to as baseline inventories, are imperative for successful monitoring programs. Monitoring, although stated as a component of ecosystem management as presented in the ten principles, is poorly documented across the services also.

Just as baseline inventories are a requirement for monitoring, so monitoring is a requirement for adaptive management. However, adaptive management is the least addressed of these three topics but requires the most explanation. There is no linkage presented in the guidance between developing ecosystem management goals and objectives, and adaptive management. To be successful, managers implementing ecosystem management must understand how to perform true adaptive management, as opposed to ad hoc management.

E. GAP ANALYSIS FINDINGS TABLES

The gap analysis findings for each service’s instructions, regulations, guidance, and guidelines are contained in the following four tables. Prior to each table there is a summary paragraph of the findings for each service.

Key elements not adequately covered in Army regulation and guidance include critical definitions, requiring annual and five-year updates, maintaining and restoring native ecosystems, and listing legal requirements within an INRMP. The following key elements are mentioned at some level of detail in at least one of the documents but require more explanation. Those include partnerships, accommodating multiple uses, information on ecosystem management, managing at an ecosystem scale, and adaptive management. For example, there is no explanation of what a multiple use is or why it is important. Inventories, INRMP as a vehicle for ecosystem management implementation, goals and objectives, and monitoring and how they make up adaptive management is lacking also. Army regulations and guidance as a whole contain enough information on some key elements such as inventories, planning for agriculture and timber management, and integrating all base plans. The following tables provide details on the gaps found in each individual regulation, guidance, or guideline.

TABLE A–1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

Key Element	Gap (yes or no)	AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)	Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)	All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000
1. General ecosystem management (EM) and the ten Principles and guidelines	Yes – no definition of EM, only limited EM terminology and explanation.	EM only discussed under forest management chapter—no other references to EM in remaining chapters; no reference to the ten Principles (predates their issuance).	Contains some EM terminology; does mention the need for clear goals and objectives and the use of an EM approach in the INRMP; no reference to the ten Principles or definition of EM.	Mentions the ten Principles when discussing developing the INRMP; no definition of or detail on EM.
2. Critical definitions	Yes	Critical definitions are lacking.	Critical definitions are lacking.	Critical definitions are lacking.
3. Manage whole ecosystem as opposed to individual species	No – sufficient information in INRMP Guidelines although not official Army policy.	Not mentioned.	States that “single species management is no longer appropriate” within installation boundaries and that managers need to consider ecosystems outside the boundaries.	Not mentioned.

TABLE A–1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)</i>	<i>Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)</i>	<i>All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000</i>
4. Develop partnerships	No – sufficient information in INRMP Guidelines although not official Army policy.	Not mentioned.	States the need for partnerships on and off base but does not provide any additional information.	Encourages coordination with public and private agencies but no explanation of the need for partnering or how to partner.
5. Accommodate human use (i.e. multiple use)	Yes – no details on what they are; no regional perspective.	Recommends multiple uses consistent with the mission, and conservation and environmental concerns; no discussion of what these multiple uses may be or the need for a regional perspective.	Mentions multiple uses; no discussion of what these multiple uses may be or the need for a regional perspective.	Not mentioned.

TABLE A–1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)</i>	<i>Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)</i>	<i>All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000</i>
6. Perform adaptive management (including monitoring and updating)	Yes – need more explanation.	Mentions monitoring with regard to ITAM responsibility, pest management agreements, ORV effects on natural resources, and threatened and endangered species but adaptive management not mentioned.	Recommends annual monitoring to determine INRMP effectiveness and mentions that adaptive management will allow projects to change; lacks information describing adaptive management or how to perform it.	Not mentioned.
7. Use the INRMP as the vehicle for development and implementation of EM	No- covered in Guidelines and All States Letter although Army may not use this letter as policy; it expired June 2001.	Not mentioned.	Clearly states that INRMP is used “to accomplish EM and biodiversity protection.”	Requires developing the INRMP using the ten Principles of EM.

TABLE A-1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

Key Element	Gap (yes or no)	AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)	Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)	All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000
8. Perform annual review and five-year revision of INRMP	No	Regulation sufficient.	Not mentioned.	Requires revisions “at least every five years.”
9. Maintain and restore native ecosystems	Yes- lacks discussion on restoring and maintaining native ecosystems.	Requires conserving native species but no mention of ecosystems; states habitat management should be used to protect and sustain biodiversity.	Not mentioned.	Not mentioned.
10. Perform inventories	No- sufficient information in INRMP Guidelines although not official Army policy.	Requires baseline inventories but no information on what should be inventoried, how or why.	States the need for thorough inventories and provides details on performing them.	Requires baseline inventories.

TABLE A-1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

Key Element	Gap (yes or no)	AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)	Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)	All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000
11. Integrate INRMP with all installation plans	No- sufficient information in All States Letter although Army may not use this letter as guidance and it expired June 2001.	Requires that Fish and Wildlife Cooperative plan be a component of the INRMP; The Endangered Species Management Plan is separate but can only be adopted if compatible with the INRMP; INRMP must be a component of the Master Plan.	States that all installation plans should be compatible with the INRMP but does not require integration.	States that the INRMP replaces the need to prepare separate management plans for particular natural resources.
12. History of and current status (e.g. inventories) of natural resources within INRMP	No- sufficient information in INRMP Guidelines although not official Army policy.	Requires inventories but no history of natural resources.	Recommends history, inventories and current status of natural resources. This is one place where the guidance is very thorough.	Requires baseline inventories but no historic information.

TABLE A-1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

Key Element	Gap (yes or no)	AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)	Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)	All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000
13. List all legal requirements pertinent to natural resources within INRMP	Yes	Not mentioned.	Does not recommend a list of legal requirements in an INRMP but does provide a list in the Guidelines.	Not mentioned.
14. Procedures and priorities for managing natural resources within INRMP	No	Requires procedure for management and a prioritization of these procedures.	Recommends goals and objectives to accomplish procedures (implementation strategy); requests priorities.	Requires a detailed schedule of procedures and priorities.
15. Procedures for ongoing identification, maintenance, and enhancement of natural resources within INRMP	No- sufficient information in INRMP Guidelines although not official Army policy.	States the need for monitoring but does not expand upon why or mention adaptive management.	Requires methods to assess the results of monitoring against objectives; requests annual monitoring of INRMP effectiveness; contains a complete inventory and monitoring section.	Not mentioned.

TABLE A–1. ARMY REGULATIONS AND GUIDANCE (INCLUDES NATIONAL GUARD BUREAU)

<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>AR 200-3 (Natural Resources – Land, Forest and Wildlife Management, 28 February 1995)</i>	<i>Guidelines to Prepare Integrated Natural Resources Management Plans For Army Installations and Activities (April 1997)</i>	<i>All States (Log Number P00-0039) Integrated Natural Resources Management Plans, 15 June 2000</i>
16. Promote the beneficial use of natural resources within INRMP	Yes	Not mentioned.	Not mentioned.	Not mentioned.

The Navy guidance reviewed here provides little information on ecosystem management, inventories, maintaining and restoring native ecosystems, and integrating all base plans with the INRMP. Other areas where gaps exist in one of the documents include critical definitions, managing whole ecosystems, multiple uses, and prioritization information. However, guidance provides good information on adaptive management, which is found in the INRMP guidelines (1998). There are also recommendations to view ecosystems regionally, develop partnerships, and perform annual and five year reviews.

TABLE A-2. NAVY REGULATIONS AND GUIDANCE			
<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Environmental and Natural Resources Program Manual, 9 September 1999 (OPNAVINST 5090.1B CH-2)</i>	<i>Guidelines for Preparing INRMPs for Navy Installations; September 1998</i>
1. General ecosystem management (EM) and the ten Principles and guidelines	Yes – no mention of the ten Principles; only limited EM terminology and explanation.	Repeats the EM requirements and provides the definition of EM from DoDI 4715.3; requires a comprehensive INRMP with an ecosystem management approach. No reference to the ten Principles.	Guidance mentions EM but no definition or details on EM; no reference to the ten Principles.
2. Critical definitions	Yes – no definition of adaptive management or monitoring.	Lists many definitions but lacks adaptive management, monitoring; doesn't discuss a regional approach to multiple uses.	Critical definitions are lacking.
3. Manage whole ecosystem as opposed to individual species	No	Sufficient guidance.	Not mentioned.

TABLE A-2. NAVY REGULATIONS AND GUIDANCE			
Key Element	Gap (yes or no)	<i>Environmental and Natural Resources Program Manual, 9 September 1999 (OPNAVINST 5090.1B CH-2)</i>	<i>Guidelines for Preparing INRMPs for Navy Installations; September 1998</i>
4. Develop partnerships	No	Requires interacting with the surrounding community through participation and education; recognizes that partnerships are essential but does not provide additional information.	Recommends many partnerships for INRMP development.
5. Accommodate human use (i.e. multiple use)	Yes – no regional perspective.	Requires human uses on base in coordination with off base when possible; no discussion on need for a regional perspective.	Mentions on-base outdoor recreation; no discussion on need for a regional perspective.
6. Perform adaptive management (including monitoring and updating)	No – covered in INRMP Guidelines, although not official Navy policy.	Adaptive management mentioned once; lacks details on what it is or how to perform it.	Recommends using adaptive management to view management objectives as a hypothesis that needs testing in order to update management objectives. Provides information on baseline and ongoing monitoring and its purpose.
7. Use the INRMP as the vehicle for development and implementation of EM	Yes	Not mentioned.	States that EM should be part of plan.

TABLE A–2. NAVY REGULATIONS AND GUIDANCE			
Key Element	Gap (yes or no)	<i>Environmental and Natural Resources Program Manual, 9 September 1999 (OPNAVINST 5090.1B CH-2)</i>	<i>Guidelines for Preparing INRMPs for Navy Installations; September 1998</i>
8. Perform annual review and five year revision of INRMP	No	Instruction sufficient.	Guidelines sufficient.
9. Maintain and restore native ecosystems	Yes – not mentioned.	Not mentioned but discusses non-native and invasive species issues and management.	Not mentioned.
10. Perform inventories	Yes – no information on what should be inventoried, why, or how.	Only requires inventories for forest ecosystems.	States the need for inventories but no information on what should be inventoried, how or why.
11. Integrate INRMP with all installation plans	Yes	Mentions integrating natural resources plans but does not mention integrating with installation plans.	Not mentioned.
12. History of and current status (e.g. inventories) of natural resources within INRMP	No	Not mentioned.	Suggests including a history of natural resource management. Requires an examination of current resources on installation from a regional perspective.

TABLE A-2. NAVY REGULATIONS AND GUIDANCE			
Key Element	Gap (yes or no)	<i>Environmental and Natural Resources Program Manual, 9 September 1999 (OPNAVINST 5090.1B CH-2)</i>	<i>Guidelines for Preparing INRMPs for Navy Installations; September 1998</i>
13. List all legal requirements pertinent to natural resources within INRMP	Yes	Does not require a list of legal requirements in an INRMP but provides a list in the Instruction.	Suggests examining legal requirements and provides a partial list in the Guidelines.
14. Procedures and priorities for managing natural resources within INRMP	No	Requires an implementation strategy and list of priorities.	States the need for setting priorities and provides some level of detail on how to do this. States need for objectives to accomplish management goals
15. Procedures for ongoing identification, maintenance, and enhancement of natural resources within INRMP	Yes	Not mentioned.	Requires such procedures but provides no information on how or why it is necessary.
16. Promote the beneficial use of natural resources within INRMP	Yes	Not mentioned.	Not mentioned.

Only one Air Force guidance was reviewed (Instruction 32-7064). Some information on ecosystem management and regional approaches to ecosystem management are provided. However, much detail on ecosystem management is lacking. Also, little information is provided on adaptive management, multiple uses, and partnering. However, the instruction contains good information on and details for critical definitions, annual and five-year reviews of the INRMP, plans for forestry and agricultural management, procedures and prioritization of projects, and basing the INRMP on ecosystem management.

TABLE A-3. AIR FORCE REGULATION		
<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Integrated Natural Resources Management, Air Force Instruction 32-7064, 1 August 1997</i>
1. General ecosystem management (EM) and the ten Principles and guidelines	Yes – only limited terminology and explanation.	EM is defined; references the ten Principles; no details on EM.
2. Critical definitions	Yes – no definition of adaptive management or invasive species.	Lists many definitions; lacks adaptive management and invasive or non native species.
3. Manage whole ecosystem as opposed to individual species	Yes	Not mentioned.
4. Develop partnerships	No	Requires undertaking partnerships when appropriate but does not stress their importance or why.
5. Accommodate human use (i.e. multiple use)	Yes – no regional perspective.	Discusses outdoor recreation and multiple uses of forestry lands; States the need to zone lands for different levels of multiple uses; no discussion on the need for a regional perspective.
6. Perform adaptive management (including monitoring and updating)	Yes – more explanation needed.	Requires monitoring all management strategies and adjusting them as needed; mentions tracking progress towards goals; no explanation of adaptive management or how to perform it.

TABLE A-3. AIR FORCE REGULATION		
<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Integrated Natural Resources Management, Air Force Instruction 32-7064, 1 August 1997</i>
7. Use the INRMP as the vehicle for development and implementation of EM	Yes	States that INRMP is based on EM.
8. Perform annual review and five year revision of INRMP	No	Sufficient Instruction.
9. Maintain and restore native ecosystems	No	States that natural resources management requires restoring and maintaining native ecosystems.
10. Perform inventories	Yes – no information on what should be inventoried, why, or how.	Requires inventories but lacks information on what should be inventoried, how, or why.
11. Integrate INRMP with all installation plans	Yes	Requires integration with natural resources plans (i.e. pest mgmt.) but not with other base plans (i.e. master plan).
12. History of and current status (e.g. inventories) of natural resources within INRMP	Yes - only mentions inventories and not an overall status of historic and current resources.	Mentions inventories but does not state which inventories; only mentions historic information needed on vegetation.
13. List all legal requirements pertinent to natural resources within INRMP	Yes	Does not require a list of legal requirements in an INRMP but provides a list in the Instruction.
14. Procedures and priorities for managing natural resources within INRMP	No	Requires details on procedures and priorities for management.

TABLE A-3. AIR FORCE REGULATION		
<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Integrated Natural Resources Management, Air Force Instruction 32-7064, 1 August 1997</i>
15. Procedures for ongoing identification, maintenance, and enhancement of natural resources within INRMP	Yes	Not mentioned.
16. Promote the beneficial use of natural resources within INRMP	Yes	Not mentioned directly but requires training of Air Force installation staff on good stewardship.

Although a definition is provided for ecosystem management in the Order 5090.2A and references the ten Principles, considerably more detail is needed. Critical definitions, managing whole ecosystems, and requiring procedures and prioritization of INRMP projects are covered in one of the guidance. However, ongoing monitoring, integrating all plans with the INRMP, requiring a list of legal requirements, performing reviews, maintaining and restoring native ecosystems, providing multiple uses, and basing the INRMP on EM are lacking in both guidance. The guidance mentions but requires more information on adaptive management and its components (i.e., inventories).

TABLE A-4. MARINE CORPS REGULATIONS AND GUIDANCE			
<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Handbook for Preparing Integrated Natural Resources Management Plans for Marine Corps Installations, November 1999</i>	<i>Marine Corps Order 5090.2A, Environmental Compliance and Protection Manual, 1 July 1998</i>
1. General ecosystem management (EM) and the ten Principles and guidelines	No	No mention of EM or the ten Principles.	Provides a definition of EM and lists what EM shall do as stated in DoDI 4715.3; references the ten Principles.
2. Critical definitions	Yes – no definition of adaptive management or invasive/non invasive species.	Critical definitions are lacking.	Lists many definitions; lacks adaptive management.
3. Manage whole ecosystem as opposed to individual species	No	Not mentioned.	Mentions a shift in management to an ecosystem and multiple species approach.

TABLE A-4. MARINE CORPS REGULATIONS AND GUIDANCE

<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Handbook for Preparing Integrated Natural Resources Management Plans for Marine Corps Installations, November 1999</i>	<i>Marine Corps Order 5090.2A, Environmental Compliance and Protection Manual, 1 July 1998</i>
4. Develop partnerships	No	Recommends internal and external stakeholder participation (i.e. local conservation groups, military organizations, and installation planners).	Requires using partnerships and volunteers when possible; states their importance to EM.
5. Accommodate human use (i.e. multiple use)	Yes – no regional perspective.	Mentions recreation; no discussion on regional perspectives and environmental issues.	Mentions recreation; no discussion on regional perspectives and environmental issues.
6. Perform adaptive management (including monitoring and updating)	Yes – more explanation needed.	Mentions creating methods to measure success of a project; adaptive management not mentioned.	Adaptive management is mentioned but no definition or implementation procedure is provided. Monitoring is mentioned once.
7. Use the INRMP as the vehicle for development and implementation of EM	Yes	Not mentioned.	States that INRMP should incorporate EM.

TABLE A–4. MARINE CORPS REGULATIONS AND GUIDANCE

<i>Key Element</i>	<i>Gap (yes or no)</i>	<i>Handbook for Preparing Integrated Natural Resources Management Plans for Marine Corps Installations, November 1999</i>	<i>Marine Corps Order 5090.2A, Environmental Compliance and Protection Manual, 1 July 1998</i>
8. Perform annual review and five year revision of INRMP	No	Recommends five-year review.	Guidance sufficient.
9. Maintain and restore native ecosystems	Yes – not mentioned.	Not mentioned.	Requires using native plants and not introducing exotics; no mention of native ecosystems.
10. Perform inventories	Yes – no information on what should be inventoried, how, or why.	Suggests baseline inventories but no information on what should be inventoried, how or why.	Not mentioned.
11. Integrate INRMP with all installation plans	Yes	Recommends integrating the INRMP with the mission.	Requires a comprehensive INRMP; no mention of integrating with other installation plans.
12. History of and current status (e.g. inventories) of natural resources within INRMP	Yes – only mentions inventories and not an overall status of historic and current resources.	Mentions developing a synopsis of past activities and updating current baseline data.	Not mentioned.

TABLE A-4. MARINE CORPS REGULATIONS AND GUIDANCE			
Key Element	Gap (yes or no)	Handbook for Preparing Integrated Natural Resources Management Plans for Marine Corps Installations, November 1999	Marine Corps Order 5090.2A, Environmental Compliance and Protection Manual, 1 July 1998
13. List all legal requirements pertinent to natural resources within INRMP	Yes	Not mentioned.	Does not require a list of legal requirements in an INRMP but provides a list in the Order.
14. Procedures and priorities for managing natural resources within INRMP	No – sufficient information in Handbook although not official Marine Corps policy.	Recommends procedures and priorities for projects, implementation vehicle, funding etc.	
15. Procedures for ongoing identification, maintenance, and enhancement of natural resources within INRMP	Yes	Not mentioned.	Not mentioned.
16. Promote the beneficial use of natural resources within INRMP	Yes	Not mentioned.	Not mentioned.

F. BIBLIOGRAPHY

Air Force Instruction 32-7064, *Integrated Natural Resources Management*, 1 August 1997. Available at <http://afpubs.hq.af.mil/pubfiles/af/32/afi32-7064/afi32-7064.pdf>

Army Environmental Policy Institute, *Army Ecosystem Management Policy Study*, AEPI-IFP-397, March 1997. Contact the editors John Fittipaldi or John Wuichet at fittipaldi@aeppi.army.mil; wuichet@aeppi.army.mil

All States (Log-Number P00-0039) *Integrated Natural Resources Plans*, 15 June 2000.

Army Regulation 200-3, *Natural Resources—Land, Forest and Wildlife Management*. 28 February 1995 (effective 28 March 1995). Available at <https://www.denix.osd.mil/denix/Public/Policy/Army/ar200-3.html>

Department of Defense, DoDI 4715.3, *Environmental Conservation Program*, May 1996. Available at <http://web7.whs.osd.mil/pdf/i47153p.pdf> or <https://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Policy/note1.html>

Department of Defense Memorandum, Deputy Under Secretary of Defense. *Memorandum on Implementation of Ecosystem Management in the DoD*. 8 August 1994. Available at <http://www.denix.osd.mil/denix/Public/ES-Programs/Conservation/Statements/note3.html>.

Guidelines to Prepare Integrated Natural Resources Management Plans for Army Installations and Activities, April 1997. Available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. U.S. Army Environmental Center (AEC) Report No. SFIM-AEC- EQ-TR-97019. For further information, contact AEC at ATTN: SFIM-AEC-EQN, Aberdeen Proving Ground, MD 21020-5401 or (410) 671-1559, DSN 584-1559. Also available through the AEC website (<http://www.aec.army.mil>) at Natural Resources Program, Guidance and Regulations Documents.

Guidelines for Preparing Integrated Natural Resources Management Plans for Navy Installations, September 1998.

Handbook for Preparing Integrated Natural Resources for Marine Corps Installations, November 1999. For a copy of this guidance, contact Jim Omans (omansjd@hqmc.usmc.mil).

Marine Corps Order 5090.2A, *Environmental Compliance and Protection Manual*, Chapter 11: "Natural Resources Management Program," July 1998. Available at <https://www.denix.osd.mil/denix/Public/Policy/Marine/5090.2A/contents.html>

OPNAVINST 5090.1B CH.2, *Environmental and Natural Resources Program Manual*, Chapter 22: "Natural Resources Management," 9 September 1999. Available at: http://neds.nebt.daps.mil/Directives/5090_1bc.pdf

The Sikes Act Improvement Act of 1997, Public Law 105-85, Div. B Title XXIX, November 18, 1997; and codified at 10 U.S.C. §§670a *et seq.* (1998) (amending the Sikes Act of 1960, 10 U.S.C. §§670a *et seq.* (1996)). Available at <http://thomas.loc.gov/home/thomas2.html> or <http://www4.law.cornell.edu/uscode/16/670a.html>

Appendix B: Ecosystem Management

Installation staff received the following case study discussion points and copy of the DoDI 4715.3 Ecosystem Management Principles and Guidelines before the case study site visits. The discussion points formed the basis for the site interviews.

A. CASE STUDY DISCUSSION POINTS

The following questions are intended to serve as discussion points rather than as comprehensive survey questions. Not all of the questions may be pertinent to all installations, and answers to many questions may overlap.

Background Information

- What is the installation's organization — do you have an organization chart?
- Where does the natural resources (NR) program fit — within Environmental, Directorate of Public Works/Installation Support?
- How many staff directly support NR?
 - Government civilian (environmental specialists, foresters, etc.)
 - ORISE
 - IPA
 - Contractor (on-site)
- What is the installation acreage? Are there satellite training, recreation or other installation areas?
- Is there a large family housing community?
- What are the major NR program areas?
- Date of signed INRMP, or anticipated date
 - Last updated —
 - Next update —

Ecosystem Management Topics

1. Are you familiar with the ten Principles of EM that were identified in DoDI 4715.3, Environmental Conservation Program? (A copy of the Principles is attached.) Were the Principles useful during development of the INRMP, or are they too general and not directly applicable to daily operations?
2. Do you think the INRMP follows an EM approach? Why or why not?

3. Have you realized any benefits from an EM approach versus a single species/single issue management approach (e.g., red-cockaded woodpecker, forest products, grazing, game species)?
4. Does EM involve dealing with more issues? Is this a reflection of EM or of a change in overall installation management?
5. Is implementing EM of value (e.g., to NR, range, mission, command, the public, state agencies, federal agencies)? Or does it not make much difference?
6. Do you have a level of comfort concerning an EM approach? Is it clear what DoD's intent is regarding EM? Or is EM an un-funded initiative and as such, cannot be fully implemented?
7. Do you think that EM is generally understood and broadly accepted by installation command and staff? Does it need to be?
8. Do State and Federal agency NR personnel understand DoD's ecosystem approach to land management?
9. Did you rely on your service's natural resources regulations and guidance in developing the INRMP? Are the regulations and guidance useful concerning EM? Do they need revision to better address EM?
10. An ecosystem approach involves managing over increased scales of space and time (e.g., location in the community, landscape, region, time). How do you think these concepts are regarded by installation operations and command? Which is the more difficult concept to convey to others - space or time?
11. Have you seen your role as a natural resources manager, forester, etc., change over the last four to six years? If so, how has it changed and why? Do you think EM has anything to do with this?
12. Do you feel comfortable with the term adaptive management? How would you describe adaptive management as it relates to your specific installation?
13. Do you have ongoing monitoring efforts? Is funding an issue?
14. How do you stay up to date on the latest technologies, survey methods, field techniques, information management, etc? Are your requests for training supported? Do you have sufficient time to attend training?
15. How is EM incorporated into your commercial forestry, rangeland or agricultural outlease programs? What EM goals and objectives do you have for these programs?
16. For agricultural or grazing leases

17. Who manages the leases? How long is the typical lease?
18. Are there special lease conditions related to EM (e.g., noxious weed control, pesticide use, water conservation, farming practices)?
19. Who is responsible for enforcement of any special conditions? Are their penalties and are they applied?
20. Does the installation hold regularly scheduled environmental management, planning or advisory committee meetings? Do you have opportunities to participate in these meetings?
21. Do you regularly update the INRMP? Have you considered how you will review and update the INRMP at the five-year point?
22. How does NR coordinate with Range and the Trainers? Is there an ITAM or equivalent program?
23. Does an EM approach help you meet coordination requirements for threatened and endangered (T&E) species? Does the INRMP include T&E management, or are there other stand-alone documents (e.g., Endangered Species Management Plan)?
24. The amended Sikes Act requires the public be given an opportunity to review INRMPs. How did you, or how will you, accomplish this?
25. Were stakeholders/interested parties involved in INRMP development? Was their involvement limited to review of National Environmental Policy Act (NEPA) documents (i.e. environmental assessment)?
26. Do partners and volunteers help with installation NR activities?
27. Does an EM approach require a different set of personnel skills and training; a more refined data management system; additional staff support; new or additional equipment?
28. Do you use and have ready access to GIS? Do you have a dedicated GIS technician?
29. Would EM training and workshops be useful? Do you have any suggestions?
30. Does EM affect planning and budgeting?
31. Do you have a vision of ecosystem health for the installation/region? Are local groups working on developing such a vision?
32. Are there installation goals and objectives for ecosystem integrity and bio-diversity?

33. Is there community-level interest in EM?
34. What kinds of off-installation activities do you think would be helpful or appropriate in your region? Under your current authorization, would you feel comfortable undertaking these types of activities?
35. Have you conducted or participated in regional workshops? If not, would your command be supportive?
36. How do you see the move toward privatization and outsourcing affecting EM?
37. What impediments are there to your success in implementing EM?
- Lack of funds
 - Lack of qualified staff, or of staff in general
 - Lack of available job openings (i.e., your program is under a hiring freeze)
 - Lack of training time or opportunities
38. What personnel issues detract from effective EM?
- Morale
 - Job security
 - Fear of litigation
 - Lack of compensation
 - Overworked/lack of staff
 - Outsourcing/privatization
 - Changing roles and responsibilities (e.g., change from field manager role to an administrative role)
39. What keeps you involved with natural resources management?
- Personal job satisfaction
 - Like challenges
 - Like field work
 - Like interacting with groups of similar interest (USFWS, State game managers, USFS, etc.)
 - Working to retire
40. For this review of EM, what other questions do you think we should be asking you and other installation managers?

B. ECOSYSTEM MANAGEMENT PRINCIPLES AND GUIDELINES

(Taken from DoDI 4715.3, Environmental Conservation Program, May 3 1996, Enclosure 6)

Goal of Ecosystem Management

To ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long term, that approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations.

Principles and Guidelines

1. Maintain and Improve the Sustainability and Native Biodiversity of Ecosystems.

Ecosystem management involves conducting installation programs and activities in a manner that identifies, maintains, and restores the "composition, structure, and function of natural communities that comprise ecosystems," to ensure their sustainability and conservation of biodiversity at landscape and other relevant ecological scales to the maximum extent that mission needs allow.

2. Administer with Consideration of Ecological Units and Timeframes. Ecosystem management requires consideration of the effects of installation programs and actions at spatial and temporal ecological scales that are relevant to natural processes. A larger geographic view and more appropriate ecological time frames assist in the analysis of cumulative effects on ecosystems that may not be apparent with smaller and shorter scales. Regional ecosystem management efforts are generally more appropriate than either national or installation-specific efforts. Consideration of sustainability under long-term environmental threats, such as climate change, is also important.

3. Support Sustainable Human Activities. People and their social, economic, and national security needs are an integral part of ecological systems, and management of ecosystems depends on sensitivity to those issues. Consistent with mission requirements, actions should support multiple use (e.g., outdoor recreation, hunting, fishing, forest timber products, and agricultural outleasing) and sustainable development by meeting the needs of the present without compromising the ability of future generations to meet their own needs.

4. Develop a Vision of Ecosystem Health. All interested parties (Federal, State, tribal, and local governments, nongovernmental organizations, private organizations, and the public) should collaborate in developing a shared vision of what constitutes desirable future ecosystem conditions for the region of concern. Existing social and economic conditions should be factored into the vision, as well as methods by which all parties may contribute to the achievement of desirable ecosystem goals.

5. Develop Priorities and Reconcile Conflicts. Successful approaches should include mechanisms for establishing priorities among the objectives and for conflict resolution during both the selection of the ecosystem management objectives and the methods for meeting those objectives. Identifying "local installation objectives" and "urban development trends" are especially important to determine compatibility with ecosystem objectives. Regional workshops should be convened periodically to ensure that efforts are focused and coordinated.

6. Develop Coordinated Approaches to Work Toward Ecosystem Health. Ecosystems rarely coincide with ownership and political boundaries so cooperation across ownerships is an important component of ecosystem management. To develop the collaborative approach necessary for successful ecosystem management, installations should:

- a. Involve the military operational community early in the planning process. Work with military trainers and others to find ways to accomplish the military mission in a manner consistent with ecosystem management.
- b. Develop a detailed ecosystem management implementation strategy for installation lands and other programs based on the vision developed in subsection B.4., above, and those principles and guidelines;
- c. Meet regularly with regional stakeholders (e.g., State, tribal, and local governments; nongovernmental entities; private landowners; and the public) to discuss issues and to work towards common goals.
- d. Incorporate ecosystem management goals into strategic, financial, and program planning and design budgets to meet the goals and objectives of the ecosystem management implementation strategy.
- e. Seek to prevent undesirable duplication of effort, minimize inconsistencies, and create efficiencies in programs affecting ecosystems.

7. Rely on the Best Science and Data Available. Ecosystem management is based on scientific understanding of ecosystem composition, structure, and function. It requires more and better research and data collection, as well as better coordination and use of existing data and technologies. Information should be accessible, consistent, and commensurable. Standards should be established for the collection, taxonomy, distribution, exchange, update, and format of ecological, socioeconomic, cartographic, and managerial data.

8. Use Benchmarks to Monitor and Evaluate Outcomes. Accountability measurements are vital to effective ecosystem management. Implementation strategies should include specific and measurable objectives and criteria with which to evaluate activities in the ecosystem. Efficiencies gained through cooperation and streamlining should be included in those objectives.

9. Use Adaptive Management. Ecosystems are recognized as open, changing, and complex systems. Management practices should be flexible to accommodate the evolution of scientific understanding of ecosystems. Based on periodic reviews of implementation, adjustments to the standards and guidelines applicable to management activities affecting the ecosystem should be made.

10. Implement Through Installation Plans and Programs. An ecosystem's desirable range of future conditions should be achieved through linkages with other stakeholders. "Specific DoD activities" should be identified, as appropriate, in installation INRMPs and ICRMPs and in other planning and budgeting documents.

Appendix C: Case Study Evaluation Procedure

A. INTRODUCTION

In the last five to ten years, natural resource management has moved from a species approach to a more holistic, ecosystem-level approach. In keeping with this, DoD has adopted ecosystem management as the approach for land management. Integrated Natural Resources Management Plans (INRMP) are the means through which DoD is implementing ecosystem management. At this time, most installations have completed or are completing their INRMPs. However, simply having a completed INRMP and implementing it does not necessarily mean that an installation is successfully implementing ecosystem management.

The purpose of this study is to assess the level of implementation of ecosystem management at DoD installations and to recommend strategies to facilitate implementation if necessary. A major component of the assessment uses a case study approach. Eight DoD installations were identified to visit and evaluate for the level of ecosystem management implementation (six were conducted by Horne Engineering and two were conducted by the Army Environmental Policy Institute (AEPI)). During the site visits, the study team posed a variety of questions to installation staff and noted the responses and other pertinent discussion topics that arose. To evaluate the level of ecosystem management implementation at eight case study sites, the team performed a case study analysis described in the final report. The evaluation procedure discussed here is intended as an internal check of the accuracy and validity of the case studies.

B. EVALUATION PROCEDURE

DoD's ten Principles of Ecosystem Management (DoDI 4715.3, Enclosure 6, 1996) are used as the basis for the evaluation procedure. DoDI 4715.3 is currently under revision; however, to the team's knowledge, the Principles will not be revised.

For the evaluation, the ten Principles are grouped into one of three key elements — goals, strategies, or procedures. This grouping of the ten Principles is taken from the AEPI's Army Ecosystem Policy Study and is used to provide an organizational basis for the evaluation. The grouping of the key elements helps organize the responses to the questions into a manageable format. As an example, Principle 1, "Maintain and improve the sustainability and native biological diversity of ecosystems" is designated as a goal-oriented key element (see table C-1, p. C-3). Responses to questions, as well as other points raised during the site visit meetings, are related back to the appropriate key element (goals, strategies, procedures) and Principles.

Implementation requirements for the ten Principles have been developed and are grouped as criteria with the corresponding Principles and associated key element (table C-1). Installations need to fulfill these criteria to implement ecosystem management to its fullest. For example, Principle 3 states that installations should "Support sustainable human activities." To implement this principle, an installation must support multiple uses

(e.g., grazing, forestry, hunting, fishing), and manage and monitor these uses for sustainability and integration into overall ecosystem management. A relative ranking is established for each criterion. The assigning of a particular rank for a given case study site will be somewhat subjective because it will be based primarily upon interpretation of the responses given during the site visits. Information from the INRMP and any follow-up communication may also contribute to the ranking.

C. RANKING

The ranking procedure allows comparison between the key elements for the installations visited — it identifies how well the installations are doing with goal-, strategy-, or procedure-oriented issues. The relative rankings for each of the key elements can then be averaged to give an overall ecosystem management ranking for the installations visited. The rankings will not be used to make comparisons between individual case study sites. Too many uncontrolled variables exist between installations to allow a valid comparison. The different installation approaches to ecosystem management and the associated outcomes will be discussed in the narrative of the case study findings report.

D. CASE STUDY EVALUATION

Averaged rankings and the range of rankings for all the case study visits appear in the table below. The findings support the policy gap analysis (Appendix A) and report findings. In the table below, Average is the mean value for all installation scores for each criterion. Range is the minimum and maximum scores for all installations for each criterion. The table below clearly illustrates a weakness across the visited installations in monitoring, adaptive management, partnering and communication, and regional perspectives to ecosystem management. Averaged rankings are significantly lower for these elements of ecosystem management. Overall, the averaged rankings and ranges are consistent with the general findings of the study. The study team is therefore confident that they have accurately represented the answers to the interview questions in the individual case studies and the findings of the final report.

**TABLE C-1: ECOSYSTEM MANAGEMENT PRINCIPLES AND THE ASSOCIATED CRITERIA
USED TO EVALUATE THE LEVEL OF IMPLEMENTATION**

<i>EM Principles*</i>	<i>Criteria Necessary for Implementation</i>	<i>Ranking Methodology</i>
GOALS		
Principle 1: Maintain and Improve the Sustainability and Native Biodiversity of Ecosystems. Principle 3: Support Sustainable Human Activities.	1. Clear goals and objectives to improve and maintain ecosystem integrity.	0 – no articulated goals/objectives 1 – goals/objectives exist but not in practice 2 – some goals/objectives practiced 3 – very clear goals/objectives being practiced for ecosystem management Average = 2.08 Range: 1-3
	2. Special EM lease conditions for grazing.	0 – no special conditions 1 – have special conditions 2 – special conditions and penalties for non-compliance 3 – special conditions and enforcement of penalties Average = N/A Range: N/A
	3. Special EM conditions in logging contracts.	0 – no special conditions 1 – have special conditions 2 – special conditions and penalties for non-compliance 3 – special conditions and enforcement of penalties Average = 1.0 Range: 1-3
	4. Installation supports multiple uses (grazing, forest product removal, outdoor recreation, hunting, or fishing).	0 – no other uses except military mission 1 – limited multiple uses 2 – selective support of multiple uses (guided by money or public pressures) 3 – fully supported multiple uses Average = 2.0 Range: 1-3
	5. Multiple uses are integrated with ecosystem management.	0 – no goals or integration of multiple uses with installation EM 1 – some goals in place for integration but ignored 2 – some goals in place for integration but not monitored for compliance 3 – multiple uses are integrated with ecosystem management Average = 1.0 Range: 0-3

**TABLE C-1: ECOSYSTEM MANAGEMENT PRINCIPLES AND THE ASSOCIATED CRITERIA
USED TO EVALUATE THE LEVEL OF IMPLEMENTATION**

<i>EM Principles*</i>	<i>Criteria Necessary for Implementation</i>	<i>Ranking Methodology</i>
S T R A T E G I E S		
Principle 2: Administer with Consideration of Ecological Units and Timeframes. Principle 7: Rely on the Best Science and Data Available. Principle 9: Use Adaptive Management.	1. EM practiced considers landscape level processes and issues.	0 – EM limited to installation boundaries 1 – EM considers landscape scales but no regional communication 2 – EM considers landscape scales but limited regional communication 3 – EM considers landscape scales and involves local and regional communication and coordination Average = 0.50 Range: 0-2
	2. The INRMP states the ecological unit (ecosystems on installation, landscape scale communities etc.) to be managed.	0 – no ecological unit is stated 1 – ecological unit is stated but not truly used or inappropriate designation 2 – ecological unit is identified for selected parts of the installation 3 – ecological unit used on installation and related to region Average = 1.5 Range: 0-3
	3. Staff use and are knowledgeable of latest technologies, survey methods, field techniques, information management etc.	0 – no qualified staff 1 – staff is not knowledgeable about latest information 2 – staff is knowledgeable but does not use the latest information 3 – staff uses and is knowledgeable about latest information Average = 3.0 Range: 3-3
	4. GIS and a technician are available.	0 – no GIS 1 – installation GIS but no Natural Resources technician 2 – has isolated, stand-alone GIS and technician; or uses regional GIS support 3 – GIS and support integrated with installation; or uses regional GIS support but integrated with installation Average = 2.0 Range: 1.5-2.5

**TABLE C-1: ECOSYSTEM MANAGEMENT PRINCIPLES AND THE ASSOCIATED CRITERIA
USED TO EVALUATE THE LEVEL OF IMPLEMENTATION**

<i>EM Principles*</i>	<i>Criteria Necessary for Implementation</i>	<i>Ranking Methodology</i>
	5. Inventories have been implemented or are planned to obtain the latest on site data.	0 – no inventories or plans for them 1 – limited or outdated inventories 2 – some complete and others planned inventories 3 – all major inventories complete Average = 2.33 Range: 0-3
	6. Ongoing monitoring efforts are in place.	0 – compliance monitoring only 1 – no additional monitoring efforts currently, but planned 2 – limited monitoring in addition to compliance 3 – targeted monitoring efforts ongoing Average = 0.66 Range: 0-2
	7. Procedures are in place to adjust goals and strategies when latest research or monitoring requires updating goals.	0 – no procedure to adjust goals/objectives and no plans to create them 1 – goals/objectives often adjusted but no procedures are in place 2 – procedures in place but not always performed 3 – procedures in place and used to adjust goals/objectives Average = 0.33 Range: 0-1
	8. Natural resource management/ environmental staff is aware and comfortable with adaptive management.	0 – staff unaware of adaptive management 1 – staff aware but using “ad hoc” management as opposed to adaptive management 2 – staff aware but not using adaptive management 3 – fully support adaptive management based on monitoring Average = 1.25 Range: 1-2.5
	9. INRMP is scheduled for regular updates.	0 – no comprehensive INRMP 1 – no scheduled review 2 – will review but no set plan or schedule 3 – scheduled and planned for regular updates Average = 2.2 Range: 1-3

**TABLE C-1: ECOSYSTEM MANAGEMENT PRINCIPLES AND THE ASSOCIATED CRITERIA
USED TO EVALUATE THE LEVEL OF IMPLEMENTATION**

<i>EM Principles*</i>	<i>Criteria Necessary for Implementation</i>	<i>Ranking Methodology</i>
PROCEDURES		
Principle 4: Develop a Vision of Ecosystem Health.	1. Has a vision of ecosystem health (assumes ideal ecosystem has been identified).	0 – no articulated vision 1 – articulated vision for the installation but ecosystem health not defined 2 – articulated vision and definition for ecosystem health for the installation 3 – articulated vision and definition for ecosystem health for the installation and the region Average = 1.83 Range: 0-3
	2. Stakeholders/ interested parties were and are involved in developing and implementing INRMP.	0 – stakeholder involvement not encouraged or wanted 1 – involved in developing only 2 – involved in implementation only 3 – active partnerships and initiatives locally and regionally Average = 0.33 Range: 0-2
	3. Staff participation in regularly scheduled installation environmental management or planning meetings.	0 – no meetings 1 – regularly scheduled meetings but not allowed to participate 2 – random meetings or regularly scheduled but with limited participation 3 – regularly scheduled meetings and full participation Average = 1.66 Range: 1-3
	4. Military operational community is involved in planning and implementation process.	0 – military community not involved 1 – military community involved in implementation only 2 – military community involved in planning only 3 – military community had and continues to have full involvement Average = 0.66 Range: 1-3

**TABLE C-1: ECOSYSTEM MANAGEMENT PRINCIPLES AND THE ASSOCIATED CRITERIA
USED TO EVALUATE THE LEVEL OF IMPLEMENTATION**

<i>EM Principles*</i>	<i>Criteria Necessary for Implementation</i>	<i>Ranking Methodology</i>
	5. Coordination with range trainers.	0 – no coordination 1 – natural resources communicates but coordination not reciprocated 2 – coordination on an as needed basis 3 – full coordination Average = 2.4 <p align="right">Range: 1-3</p>
	6. Identified benchmarks for ecosystem management monitoring and evaluation.	0 – no benchmarks or predicted outcomes 1 – very limited benchmarks/only for T & E species 2 – do have benchmarks but no evaluation procedure 3 – have benchmarks and evaluation procedure in practice Average = 1.17 <p align="right">Range: 0-3</p>
	7. Ecosystem management is planned and prioritized throughout installation plans.	0 – prioritize only those projects expected to be funded 1 – no prioritization 2 – some EM projects are prioritized and coordinated 3 – all EM projects are prioritized and coordinated Average = 1.33 <p align="right">Range: 0-2</p>

Appendix D: Trip Reports

A. FORT STEWART, GEORGIA

Date: 25-26 September 2000

Place: Fort Stewart, Georgia

Travelers: John Fittipaldi, Army Environmental Policy Institute
John Wuichet, Army Environmental Policy Institute
Dorothy Gibb, Ph.D., Project Manager,
Horne Engineering Services, Inc.
Don Maglienti, Associate Scientist,
Horne Engineering Services, Inc.

Points of Contact: Linton Swindell (Fort Stewart)

Meeting Attendees:

Day 1	Day 2
Tim Beaty (Supervisor, Endangered Species)	Tim Beaty
Thomas Fry (Chief, Environmental and Natural Resources Div.)	Drew Brown (ITAM Coordinator Contractor)
Jeff Mangun (Supervisor, Fire Management)	Thomas Fry
Jerry Purcell (Supervisor, Timber Management)	Tom Hilliard
Linton Swindell (Chief, Fish and Wildlife Branch, ENRD)	(Chief, Forestry Branch, ENRD)
Jeff Purcell	Jeff Mangun
	Linton Swindell

Meeting Purpose:

Our purpose was to talk with Fort Stewart's natural resources managers about opportunities for, constraints to, and successes in implementing ecosystem management and forestry on the installation. The meeting was the first of eight case study analyses conducted as part of an evaluation of DoD ecosystem management.

Installation Overview:

Fort Stewart is the largest Army installation east of the Mississippi River. It is located about 40 miles southwest of Savannah, Georgia, and covers about 279,270 acres, including parts of five counties. Hunter Army Airfield, part of the Stewart/Hunter complex, is located in Savannah and covers about 5,400 acres. The installation is currently home to the 3d Infantry Division (Mechanized). The Fort Stewart and Hunter Army Airfield mission is "to provide the 3d IN DIV (Mech) and tenant activities with the support necessary to effectively train, mobilize, and deploy a mechanized infantry division and follow-on Active Component (AC) and Reserve Component (RC) units while providing a high standard quality of life." Mission-related activities that occur on the installation and that can affect the landscape include training on tracked vehicles, field artillery, helicopter gunnery, and small arms ranges. Fort Stewart supports a

working population of approximately 20,000 military and civilian employees, including their dependents.

The Environmental and Natural Resources Division (ENRD) is within the Directorate of Public Works (DPW). The ENRD contains the program area management units important to this case study. In particular, the Fish and Wildlife Branch and the Forestry Branch have natural resources management responsibilities that can affect ecosystem management. The Integrated Training Area Management (ITAM) program, which is within the Directorate of Plans, Training, and Mobilization (DPTM), also has staff that support natural resources management as related to training.

Meeting Overview:

Day 1: We met with Fort Stewart ENRD staff. Mr. Swindell, our primary point of contact, arranged to have staff from the Forestry Branch and the Fish and Wildlife Branch participate in the meeting. In preparation for the meeting, we sent Mr. Swindell a list of discussion topics/questions on EM implementation. We used this list as a focus for discussion. During the meeting, we also discussed Fort Stewart's forestry program. The discussions were intense and informative, and reflected a high degree of staff enthusiasm and willingness to participate.

Day 2: The meeting resumed in the morning to continue discussing ecosystem management topics. Mr. Drew Brown, ITAM Coordinator, and Mr. Tom Hilliard, Forestry Branch Chief, joined the meeting. The meeting continued during lunch with AEPI, Horne Engineering, and installation staff. After lunch, we were given an extensive tour of the installation forest areas—red cockaded woodpecker habitat, training areas, prescribed burn areas, forested areas, and open areas.

Main Issues Discussed During the Meetings and Installation Tour:

- Ecosystem management at Fort Stewart – Integrated Natural Resources Management Plan (INRMP) as a vehicle for implementation
- Status of the INRMP, including the incorporation of the forest management plan
- Interactions with local community – concerns regarding “beyond the fence” issues
- Respective roles of ITAM natural resources staff and installation natural resources managers
- Coordination between DPTM/ITAM and ENRD
- Effects of forest practices/timber removal on military mission and training
- Operation and maintenance budgeting/funding vs. Forestry Program budgeting/funding
- Prescribed burn operations
- Red cockaded woodpecker management as the driver of ecosystem management at Fort Stewart

- Impediments to ecosystem management from installation organizational structure/chain of command
- Constraints to achieving forest stocking/timber harvest goals
- Outreach and education initiatives

B. TINKER AIR FORCE BASE, OKLAHOMA

Date: 13-14 December 2000

Place: Tinker Air Force Base, Oklahoma

Travelers: Dorothy Gibb, Ph.D., Project Manager,
Horne Engineering Services, Inc.
Debbie Hahn, Associate Scientist, Horne Engineering Services, Inc.

Point of Contact: John Krupovage (Tinker Air Force Base)

Meeting Attendees:

Day 1

John Krupovage

(Chief of Environmental Support Branch)

Raymond Moody

(Natural Resources Biologist)

Day 2

John Krupovage

Raymond Moody

Meeting Purpose:

Our purpose was to talk with Tinker Air Force Base's natural resources staff about opportunities for, constraints to, and successes in implementing ecosystem management on the installation. The meeting was the second of eight case study analyses conducted as part of an evaluation of DoD ecosystem management.

Installation Overview:

Tinker Air Force Base (AFB) was officially opened in 1941. Tinker AFB is an Air Force Materiel Command installation located in Oklahoma City, Oklahoma. It is located about nine miles southeast of downtown Oklahoma City and covers over 5,000 acres, including the Oklahoma City Air Logistics Center (OC-ALC). The Tinker AFB mission is "dedicated to providing worldwide technical logistics support to Air Force aerospace weapon systems, equipment, and commodity items, and encompasses a myriad of responsibilities." The OC-ALC manages numerous aircraft, engines, missiles, and commodity items. In addition to the OC-ALC, Tinker accommodates two large Air Combat Command support units and is home operating base for the 552nd Air Control Wing flying the E-3 Sentry, and the Air Force Reserve's 507th Air Refueling Wing. Tinker AFB also houses the Navy's E-6A Strategic Communications Wing One. Mission-related activities that occur on the installation that can affect the surrounding ecosystem include but are not limited to aircraft maintenance activities, aircraft landings and take offs, industrial wastewater treatment plant operations, training exercises, roadway ice control, industrial/residential expansion, and shooting range activities. Tinker Air Force Base supports a working population of approximately 22,000 military and civilian employees. It is the largest single-site employer in Oklahoma City.

The Environmental Restoration Division (EMR) is one of three divisions in the Environmental Management Directorate. The EMR contains the program area management units important to this case study. In particular, the EMR contains Tinker's Natural Resource Program. The base has recently gone through the A-76 process,

resulting in a reduction in the number of natural resources staff while simultaneously increasing responsibility.

Meeting Overview:

Day 1: We met with Tinker AFB Natural Resources staff. Mr. Krupovage, Chief of Environmental Support Branch and our primary point of contact, arranged to have his coworker Raymond Moody, natural resources biologist, at the meeting also. Mr. Moody also has responsibility for NEPA. In preparation for the meeting, we sent Mr. Krupovage a list of discussion topics/questions on EM implementation. We used this list as a focus for discussion. The discussions were intense and very informative, and reflected a high degree of staff enthusiasm and willingness to participate.

Day 2: The meeting resumed in the morning with a continued discussion of ecosystem management topics. We were also given an extensive tour of the installation—golf course, greenway (recreational reserve/multi-use trail system), base housing, industrial complex, airfield, and clear zones.

Main Issues Discussed During the Meetings and Installation Tour:

- Status of the INRMP
- Ecosystem management at Tinker AFB —INRMP and Annual Action Plan as a vehicle for implementation
- Prescribed burn operations and native prairie grass plantings
- Greenway maintenance, management, and expansion
- Impediments to ecosystem management due to installation organizational structure/chain of command
- Outcomes of A-76 process
- Respective roles of command and installation natural resources managers
- Coordination between various branches of EM and Civil Engineering
- Effects of natural resources management on military mission
- Installation natural resource managers as advisors in areas on the base where they do not have authority, responsibility, or funding to be the implementers
- Improving communication with installation commander
- Constraints to achieving natural resources management goals
- Interactions with local community; concerns regarding “beyond the fence” issues
- Outreach and education initiatives
- Tree farm creation and how it facilitates partnerships with local organizations
- Natural Resource Program budgeting/funding
- Funding and volunteer sources

C. FORT KNOX, KENTUCKY

Date: 8-9 February 2001

Place: Fort Knox, Kentucky

Travelers: John Fittipaldi, Army Environmental Policy Institute
Dorothy Gibb, Ph.D., Project Manager,
Horne Engineering Services, Inc.
Sheldon Gen, Georgia Institute of Technology

Points of Contact: Albert Freeland, Chief, Environmental Management Division, Fort Knox

Meeting Attendees:

Day 1	Day 2 (Installation tour)
Gail Pollock (Environmental Protection Specialist)	Gail Pollock
Bob Makowski (Forester)	
Michael Brandenburg (Wildlife Biologist)	

Meeting Purpose:

Our purpose was to talk with Fort Knox's Environmental Management Division's natural resource managers about their progress and challenges in implementing ecosystem management on the installation. The meeting was the third of eight case study analyses conducted as part of an evaluation of DoD ecosystem management.

Installation Overview:

Fort Knox is an Army installation located in north-central Kentucky, about 31 miles south of Louisville. It lies in a rural setting, with the communities of Radcliff and Lebanon Junction adjacent and Elizabethtown about 17 miles to the south. The installation spans three counties: Bullitt, Hardin, and Meade. The installation encompasses 109,068 acres, which are primarily a forest ecosystem interlaced with riparian areas.

Fort Knox is in the Army's Training and Doctrine Major Command. Its primary mission is to develop leaders and train soldiers for the armored force. It is the national center for armor and cavalry training, training personnel from all branches of the US military and military units of other nations. Mission activities impacting the landscape include maneuver training (mechanized/armor training), live weapon firing, and dismounted infantry operations.

Fort Knox's natural resources staff has primary responsibility for implementing the installation INRMP. The Natural Resources program housed within the Environmental Management Division (EMD) of the Directorate of Base Operations Support (DBOS). DBOS reports to the Garrison Commander, who directs the overall management of Fort Knox facilities.

Meeting Overview:

Day 1: We met with three managers from the EMD: Gail Pollock, environmental specialist and NEPA coordinator; Bob Makowski, forestry manager; and Mike Brandenburg, fish and wildlife section. Our discussions were guided by the same list of topics and questions on ecosystem management used in the previous site visits. The first day's discussions began at 9:00 a.m. and continued to approximately 5:00 p.m. with a lunch break. The discussions were intense and the participants were candid and willing to share their successes and challenges.

Day 2: Gail Pollock led us on a tour of the installation's training ranges, facilities, waterways, and forested areas. This included training ranges that were in moderate condition as well as those that are overused. Following the tour we met briefly with Don McGarr and James Albright of EMD, who oversee the installation's compliance wastewater and storm water permits. Finally, we briefly met again with Gail Pollock, who showed us photographs of a completed creek restoration project on the installation.

Main Issues Discussed During the Meetings and Installation Tour:

- Ongoing update of the Fort Knox INRMP
- Status of the ITAM program; its lack of funding for the past few years; its previous success
- Land rotation for training maneuvers and impacts on EM and the landscape; long term planning for training; internal communications related to EM
- Relative placements of natural resource management and ITAM staff in the Fort Knox organizational structure
- Forestry management; absence of reimbursable forestry program
- Implementation of the INRMP and the support for implementation
- Perspectives and objectives of EMD and Range
- Outside stakeholders in EM at Fort Knox; government and non-government stakeholders; outreach efforts
- Recreational hunting and fishing
- Internal communication
- NEPA activities at Fort Knox
- Staffing and staff morale

D. NAVAL BASE VENTURA COUNTY, POINT MUGU, CALIFORNIA

Date: 19-20 March 2001

Place: Naval Base Ventura County, Point Mugu, California

Travelers: John Fittipaldi, Army Environmental Policy Institute
Deborah Hahn, Associate Scientist,
Horne Engineering Services, Inc.
Jessica Metzger, Associate Scientist,
Horne Engineering Services, Inc.

Points of Contact: Tom Keeney (Point Mugu)

Meeting Attendees:

Day 1	Day 2
Tom Keeney (Ecologist/Natural Resources Manager)	Tom Keeney Barbara Ball
Ron Dow (Environmental Division Director)	Jennifer Guigliano
Dan Shide (Environmental Protection Branch Head)	
Barbara Ball (Research Specialist - GIS)	
Jennifer Guigliano (Contractor, Environmental Engineer)	

Meeting Purpose:

Our purpose was to talk with Point Mugu's natural resources manager about opportunities for, constraints to, and successes in implementing ecosystem management on the installation. The meeting was the fourth of eight case study analyses conducted as part of an evaluation of DoD ecosystem management.

Installation Overview:

Naval Base Ventura County Point Mugu is located on the California coast about 65 miles northwest of Los Angeles. It covers about 4,600 acres and includes about 2,600 acres of jurisdictional wetlands. The coastal location offers an isolated area, which encompasses a 36,000 square-mile, fully instrumented and integrated sea test range for test and evaluation of weapons and aircraft systems. The installation is currently home to more than forty tenants. The primary mission-related activity at Point Mugu is aircraft testing. Point Mugu supports a working population of approximately 5,000 military and civilian employees.

The Environmental Division is within the Public Works department. The Environmental Division contains the program area management units important to this case study. In particular, the Natural Resources area under the Environmental Protection Branch has responsibilities that can affect ecosystem management. Until 1998, management of San

Nicholas Island and the sea test range were under Point Mugu; however, management responsibilities for these areas are now with NAWS China Lake.

Meeting Overview:

Day 1: We met with Point Mugu Environmental Division staff to discuss ecosystem management and base operations. Mr. Keeney, our primary point of contact, arranged to have the heads of the Environmental Division and Environmental Protection Branch participate in part of the meeting. Mr. Keeney and two contractors for natural resources participated in the meeting for the whole day. In preparation for the meeting, we sent Mr. Keeney a list of discussion topics/questions on ecosystem management implementation. We used this list as a focus for discussion. The discussions provided a wealth of information and displayed the passion of the natural resources staff at Point Mugu. The meeting continued during lunch with AEPI, Horne Engineering, and Mr. Keeney. After lunch, we were given the first part of the installation tour.

Day 2: The meeting resumed in the morning to continue discussing ecosystem management topics. Lyn Perry and Martin Ruane, full-time natural resources technicians (contractor support from Engineering Management Concepts, Inc.), were present briefly. We then completed an extensive tour of the installation — mountain overlook, salt marsh, tidal flat, and beach habitat.

Main Issues Discussed During the Meetings and Installation Tour:

- Ecosystem management at Point Mugu
- Status of the INRMP
- Interactions with local community; concerns regarding “beyond the fence” issues and partnering
- Coordination between pilots, air traffic control, tenants, and the natural resources staff
- Endangered species management (California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus*), light-footed clapper rail (*Rallus longirostris levipes*) and wetland regulations as the drivers of ecosystem management at Point Mugu
- Impediments to ecosystem management from installation organizational structure/chain of command
- Outreach and education initiatives and needs on and off base
- Staffing, contracting, and partnering issues
- The importance of Geographic Information Systems (GIS) for installation natural resources management
- Acquiring and collecting and analyzing high quality data
- Bird Air Strike Hazard plan (BASH)

- Funding of natural resources projects
- Challenges to achieving ecosystem management goals

E. MARINE CORPS LOGISTIC BASE (MCLB) BARSTOW, CALIFORNIA

Date: 21 March 2001

Place: Marine Corps Logistic Base (MCLB) Barstow, California

Travelers: John Fittipaldi, Army Environmental Policy Institute
Deborah Hahn, Associate Scientist,
Horne Engineering Services, Inc.
Jessica Metzger, Associate Scientist,
Horne Engineering Services, Inc.

Point of Contact: Art Gleason (MCLB Barstow)

Meeting Attendees: Art Gleason (Environmental Protection Specialist)
Manuel Joia (NEPA/CEQA)

Meeting Purpose:

Our purpose was to talk with MCLB Barstow's natural resources manager about opportunities for, constraints to, and successes in implementing ecosystem management on the installation. The meeting was the fifth of eight case study analyses of DoD installations conducted as part of an evaluation of the implementation of ecosystem management across DoD.

Installation Overview:

MCLB Barstow is located about 150 miles from Los Angeles, California in the Mojave Desert and covers about 5,700 acres. The base is comprised of three principal sites: Nebo, which encompasses 1,568 acres and functions as base headquarters, comprising the main facility for administration, storage, recreational activities, shopping, and housing functions; the Yermo Annex, which encompasses about 2,000 acres and is primarily a storage and industrial complex; and a third site of approximately 2,500 acres that serves as the rifle and pistol ranges. Most natural resources activities are performed on the rifle range because the remainder of the installation is developed.

MCLB Barstow's mission is to provide the highest quality support for maintenance, repair, rebuild, storage, and distribution of principal end items of equipment and supplies. Mission-related activities that occur on the installation and that can affect the landscape include rifle range activities. Barstow supports a working population of approximately 2,000 military and civilian employees.

The Environmental Division is within the Installation and Logistics Department. However, under the ongoing restructuring the Environmental Division will most likely become an independent department. The Environmental Division contains the natural resources program area important to this case study.

Meeting Overview:

We met with Mr. Gleason, the only natural resources staff and our primary point of contact. Mr. Gleason's main ecosystem management responsibilities include desert tortoise (*Gopherus agassizii*) management and participation in three regional partner groups — the Desert Managers Group (DMG), the Planning and Coordination of Installation Desert Resource Managers (PACIDERM), and the Mojave Desert Ecosystem Program. Mr. Joia was also present for the morning session. Mr. Joia's current position is in NEPA compliance; however, he may take over natural resources management responsibilities upon Mr. Gleason's retirement.

In preparation for the meeting, we sent Mr. Gleason a list of discussion topics/questions on ecosystem management implementation. We used this list as a focus for discussion. Mr. Gleason was enthusiastic and spent much time discussing ecosystem management at MCLB Barstow. The meeting continued during lunch with AEPI, Horne Engineering, and installation staff. We were also given an extensive tour of the installation — rifle range, maintenance areas, archeological areas and desert tortoise habitat.

Main Issues Discussed During the Meetings and Installation Tour:

- Ecosystem management at Barstow
- Status of the INRMP
- Participating and partnering with the DMG, PACIDERM, and the Mojave Desert Ecosystem Program
- Coordination between range manager, maintenance crews and the natural resources staff
- The threatened desert tortoise as the driver of ecosystem management at MCLB Barstow
- Effects of organizational structure/chain of command on ecosystem management
Staffing the natural resources program
- The importance of the regional Geographic Information Systems housed in the City of Barstow and managed under Mr. Clarence Everly for the Mojave Desert Ecosystem Program
- Funding for natural resources projects
- Exotic species in the desert ecosystem

F. ROBINS AIR FORCE BASE, GEORGIA

Date: 10 April 2001

Place: Robins Air Force Base, Georgia

Travelers: John Fittipaldi, Army Environmental Policy Institute
John Wuichet, Army Environmental Policy Institute

Points of Contact: Steven Coyle, Director of Environmental Management
Bob Sargent, PhD, Natural Resources Manager
Bobby Ellis, Environmental Management Staff
Becky Crader, Environmental Management Staff

Meeting Attendees: John Fittipaldi, Army Environmental Policy Institute
John Wuichet, Army Environmental Policy Institute
Steven Coyle, Director of Environmental Management
Bob Sargent, PhD, Natural Resources Manager
Bobby Ellis, Environmental Management Staff
Becky Crader, Environmental Management Staff

Meeting Purpose:

Our purpose was to talk with Robins AFB personnel about opportunities for and constraints to implementing ecosystem management on the installation. The meeting was the sixth case study conducted as part of an evaluation of DoD ecosystem management. Our meeting resulted from coordination that began with George Carellas at the DoD Region IV Office, who recommended we speak with Dave Brentzel at the Air Force Regional Office, who recommended Steven Coyle at Robins AFB, who recommended Bob Sargent, the natural resources manager.

Installation Overview:

Robins Air Force Base is the home of Warner Robins Air Logistics Center (WR-ALC) and more than sixty other units including the Air Force Reserve Command Headquarters. Robins AFB is situated on 8,722 acres (of which about 1,700 acres are leased to hunters) and contains more than 14 million square feet of facilities. Robins has the largest runway in Georgia, capable of accommodating the largest aircraft in the world, including the C-5B Galaxy and the NASA Space Shuttle piggybacked on a Boeing 747. It has more than 1,400 family housing units (much it outside the post). Construction began on the new Georgia Air Depot, located 16 miles south of Macon, on 1 September 1941. Warner Robins Air Logistics Center is one of five such centers in the Air Force, with worldwide management responsibility for the repair, modification, and

overhaul of the F-15 Eagle, the C-130 Hercules, the C-141 Starlifter, the C-5 Galaxy and all Air Force helicopters. The center also provides logistical support for all Air Force missiles, vehicles, general-purpose computers, avionics, and electronic systems for most aircraft.

Meeting Overview:

We went over the prepared questions, continued with an informal discussion on various issues related to ecosystem management, and concluded with a tour of the installation by car and on foot.

Main Issues Discussed During the Meetings:

At the conclusion of our meeting, Bob Sargent offered an excellent overview/summary of his perspectives:

- (1) A lack of resources is a persistent problem for natural resources management at Robins AFB, primarily because natural resources management funding is driven mostly by the presence of protected species. Robins has no protected species, but that doesn't mean they don't have statutory and regulatory natural resources management requirements.
- (2) Excessive reporting ties hands and slows down progress on actually "doing."
- (3) Privatization and A-76 has meant a loss of job security, which translates into weakened morale. A-76 hurts morale. One third of the staff flees; replacements are temps; too much time to justify existence rather than actually working.
- (4) Regulations are becoming increasingly unenforceable due to the lack of funds caused by a lack of endangered species. Unfunded mandates only exacerbate this problem.
- (5) Educating the incoming Base Commander is crucial. Endangered species and wetlands are the only natural resources management issues that can send a Commander to jail, and are therefore the most important issues to get across given limited face time. Ecosystem management has no such "stick," and therefore there is little knowledge or understanding among Commanders about biodiversity, because it is not likely to be taught in the Commander "charm schools."
- (6) Urbanization is a problem that can only get worse. Many of our neighbors do not enjoy the same conservation ethic that we do, and we are the ones who suffer from their development.
- (7) Inter-service cooperation is important. We know who our counterparts are in Georgia and the region, but it is an extended peer group at best, and it needs to be stronger.

- (8) Image is just as important as actual good stewardship. We're seen as hunters and loggers by many who live off post, and yet we're seen as tree-huggers by our own soldiers. Our highest and best name should be simply "natural resource managers."

G. NAVAL SUBMARINE BASE KINGS BAY, GEORGIA

Date: 11 April 2001

Place: Naval Submarine Base Kings Bay, Georgia

Travelers: John Fittipaldi, Army Environmental Policy Institute
John Wuichet, Army Environmental Policy Institute

Points of Contact: Ron Wilkinson, Natural Resources Manager
LT Len Schilling, PE, Facilities and Environmental Deputy

Meeting Attendees: John Fittipaldi, Army Environmental Policy Institute
John Wuichet, Army Environmental Policy Institute
Ron Wilkinson, Natural Resources Manager
LT Len Schilling, PE, Facilities and Environmental Deputy

Meeting Purpose:

Our purpose was to talk with Naval Submarine Base Kings Bay personnel about opportunities for and constraints to implementing ecosystem management on the installation. The meeting was the seventh case study conducted as part of an evaluation of DoD ecosystem management. Our meeting resulted from coordination that began with George Carellas at the DoD Region IV Office, who recommended we speak with Jerry Walmeijer at the Navy Regional Office, who recommended John Garner at Kings Bay, who recommended Ron Wilkinson, the natural resources chief.

Installation Overview:

Kings Bay is one of the newest installations in the United States. Although initially commissioned in 1978 as a 9,000 acre standby ocean terminal for the Army, it was not until 1982 that the installation was handed over to the Navy to become a 16,225 acre home for Navy submarines. Construction of Kings Bay was the largest peacetime construction program ever undertaken by the US Navy. The Trident Training Facility is the largest building in Camden County, and the Trident Refit Facility has the largest covered dry dock in the Western hemisphere. Kings Bay is home to 229 species of birds, 68 mammals, 67 reptiles (including 5 poisonous snakes), and 37 amphibians. Twenty of these species are threatened or endangered, including marine mammals such as the Manatee and the Right Whale, and terrestrial species such as the gopher tortoise and possibly the indigo snake. Of the Base's 16,225 acres, about 4,000 are protected wetlands.

Meeting Overview:

We went over the prepared questions, talked informally about ecosystem management and installation natural resources management, and toured the installation by car and on foot.

Main Issues Discussed During the Meetings:

Some installation goals for natural resource management are set at the regional level through an Integrated Natural Resources Management Plan (INRMP). The last INRMP was completed 11 years ago, and is currently under revision. The Environmental Assessment, required for the Plan by the National Environmental Policy Act, is available in the local library. The comment period recently ended, and there were no comments received. The South Division of the Naval Facilities Engineering Command (SouthDiv: NAVFACENGCOM) is leading INRMP preparation by using the same statement of work for all plans in the region. This helps with consistency and also with encouraging a regional perspective. Similarly, protection of the Right Whale is managed regionally by Jerry Walmejer at the Navy Regional Environmental Office.

F. MARINE CORPS BASE QUANTICO, VIRGINIA

Date: 29 August 2001

Place: Marine Corps Base Quantico, Virginia

Travelers: Debbie Hahn, Associate Scientist, Horne Engineering Services, Inc.
Mark Wilson, Environmental Intern,
Horne Engineering Services, Inc.

Point of Contact: Bruce Frizzell, Head, Natural Resources and Environmental Affairs
(NREA) Marine Corps Base Quantico

Meeting Attendee: Bruce Frizzell

Meeting Purpose:

Our purpose was to talk with Marine Corps Base Quantico's natural resources staff about opportunities for, constraints to, and successes in implementing ecosystem management on the installation. This meeting was the last of eight case study analyses conducted as part of an evaluation of DoD ecosystem management.

Installation Overview:

Marine Corps Base Quantico is located on the western banks of the Potomac, about 35 miles south of Washington D.C in Prince Williams County, Virginia. The base encompasses approximately 60,000 acres bisected by Interstate 95. The eastern side is about 5,000 acres and the rest of the acreage resides on the western side of Interstate 95. In 1916, then-Major General Commandant of the Marine Corps George Barnett sent a board to find possible sites for a new Marine Corps base in the vicinity of Washington, D.C. In 1917, a portion of the area now called Marine Corps Base Quantico became the Marine Barracks Quantico. Today, Quantico supports a working population of approximately 13,000 military and civilian employees including dependents. This number fluctuates due to training sessions.

Marine Corps Base Quantico's primary mission is to train Marine Corps Officers. Training includes live fire exercises, orienteering, field exercises, and some tank training. The Marine Corps University is located at Quantico. All Marine officers must attend Quantico's Officers Candidate School at the Marine Corps University. Some major units based at Marine Corps Base Quantico include Marine Helicopter Squadron One, and Company D, 4th Light Armored Reconnaissance Battalion.

The Natural Resources and Environmental Affairs (NREA) Branch is one of four branches located under the Facilities Division. The NREA contains seven sections: Fish, Wildlife, and Agronomy; NEPA Coordination; Environmental Affairs; Environmental Engineering; Forestry; Environmental Law Enforcement; and Installation Restoration Program.

Meeting Overview:

We met with Bruce Frizzell, head of the NREA and our primary point of contact. In preparation for the meeting, we sent Mr. Frizzell the list of discussion topics/questions on EM implementation. We used the list as a focus for discussion.

Main Issues Discussed During the Meetings:

- Status of the Integrated Natural Resources Management Plan (INRMP)
- Ecosystem management at Marine Corps Base Quantico — INRMP and how it may help implement ecosystem management
- Timber sales and the management of forest health
- Encroachment from the surrounding communities
- Increased pressures to develop currently undeveloped lands on the installation
- Impediments to ecosystem management due to installation organizational structure/chain of command
- Effects of the ongoing A-76 process
- Respective roles of command and installation natural resources managers
- Coordination between NREA sections and Range
- Effects of natural resources management on military mission
- Constraints to achieving natural resources management goals
- Interactions with local communities and the level of community interest
- Natural resource program budgeting/funding
- Funding and the volunteer program
- Fish and game permits/licenses

Appendix E: Case Studies

A. FORT STEWART

Installation Background

Located about 40 miles southwest of Savannah, Georgia, Fort Stewart is the largest Army installation east of the Mississippi River. Fort Stewart encompasses approximately 279,270 acres, including parts of five counties. Hunter Army Airfield, part of the Stewart/Hunter complex, is located in Savannah and covers about 5,400 acres. The installation is currently home to the 3d Infantry Division (Mechanized). The Fort Stewart and Hunter Army Airfield mission is “to provide the 3d IN DIV (Mech) and tenant activities with the support necessary to effectively train, mobilize, and deploy a mechanized infantry division and follow-on Active Component (AC) and Reserve Component (RC) units while providing a high standard quality of life.” Mission-related activities that occur on the installation and that can affect the landscape include training on tracked vehicles, field artillery, helicopter gunnery, and small arms ranges. Fort Stewart supports a working population of approximately 20,000 military and civilian employees, including their dependents.

About 220,000 acres of the installation are managed forestland, mostly longleaf pine and mixed pine forests. Fort Stewart conducts prescribed burns on approximately 120,000 acres each year as part of their forest management activities. Thinnings and timber stand improvement operations are also conducted. Fort Stewart produces a variety of forest products including saw timber, pulpwood, and pine straw.

A major management concern of the installation is endangered species management. Fort Stewart supports a healthy red-cockaded woodpecker (RCW) population⁴ as well as other state and federally protected plant and animal species. A major component of the natural resources management activities is conducted to restore, maintain, and protect RCW habitat. Other management concerns for Fort Stewart are erosion and water quality protection.

⁴ The red-cockaded woodpecker, *Picoides borealis*, is listed as an endangered species and is protected under the Endangered Species Act of 1977, as amended. Military installations with known federally listed threatened or endangered species are required by ESA to manage for the recovery of the species. The red-cockaded woodpecker makes its home in mature pine forests; more specifically, those with long-leaf pine averaging 80 to 120 years and loblolly pine averaging 70 to 100 years. While other woodpeckers bore out cavities in rotten and soft wood in dead trees, the red-cockaded woodpecker excavates cavities exclusively in living pine trees. From the late 1800s to the mid 1900s, the species population rapidly declined as its mature pine forest habitat was altered through a variety of means, primarily timber harvest, conversion to agriculture, and fire suppression. The species was listed as endangered in 1970 under a law that preceded the Endangered Species Act.

Case Study Analysis

Fort Stewart is representative of a large installation with a high profile endangered species and a potential for high training impacts. It has the largest reimbursable forestry program of installations in the Eastern United States and typically is a major contributor to the DoD Forestry Reserve Account. Fort Stewart was the first installation visited for the case study analysis and provided the most lively and intense discussions, with staff participating into the evening hours.

Vision, Goals, and Objectives

Ecosystem management has been the management approach used at Fort Stewart for almost ten years. Much of the initial impetus for ecosystem management developed from a biological opinion for federally listed threatened and endangered species. Today Fort Stewart is home to five listed threatened and endangered species as well as thirty-seven plants and twenty-six animals that are considered species of special concern. The presence of so many threatened and endangered species on the installation has both positive and negative effects on ecosystem management. Endangered species management is well supported because of the need for compliance with the Endangered Species Act, and the program is well staffed and funded. However, in some instances the compliance-driven emphasis on endangered species means that the natural resources staff are unable to integrate natural resources management to the desired level of integration. Many goals and objectives outlined in the INRMP are driven by the need for compliance with the Endangered Species Act and the various biological opinions of the U.S. Fish and Wildlife Service.

Fort Stewart's current INRMP covers the years 2000-2004. The INRMP outlines Fort Stewart's ecosystem management. It addresses policies and goals that support military readiness, stewardship, quality of life, compliance, and program integration. The natural resources staff firmly believes in the integrated natural resources management planning process and the emphasis on program integration — fish and wildlife, endangered species, forestry, range management, and master planning. The staff considers the INRMP a good tool to achieve ecosystem management. Its development and implementation have allowed the staff to consider a greater range of topics and issues.

The installation natural resources staff has identified the longleaf pine-wiregrass community as the primary community for ecosystem management. This native vegetation community type provides excellent habitat for the red-cockaded woodpecker as well as many other native plants and animals. Due to the natural spacing of trees in the longleaf pine-wiregrass community, these areas also provide optimal military training conditions because they allow the passage of tracked and other training vehicles. In developing a vision for the installation, Fort Stewart was unable to identify any local or regional groups with a similar interest in natural resources planning and ecosystem management. Although Fort Stewart is close to the Savannah and coastal resort area, most of the installation is surrounded by rural farming and forestry and there is little interest, and perhaps little perceived need, by the local community in developing a regional vision for land management.

Organizational Challenges

The Fort Stewart natural resources staff is located within the Environmental and Natural Resources Division (ENRD), which is a division of the Directorate of Public Works (DPW). The natural resources managers at Fort Stewart understand that their role has expanded with ecosystem management, but they feel unable to be fully effective due to their relatively low organizational position and its associated limited authority. Today's natural resources managers are operating at a much higher level — in addition to their technical expertise in different natural resources fields, the natural resources managers are responsible for program integration and can find themselves in the position of being mediators for public relations issues related to training and other installations activities. The managers believe that their management roles in the future will be less about inventorying and data collection and more about interpretation and articulation of installation policy. However, under the current organization there are many constraints to meeting the responsibilities of these roles.

The ITAM program at Fort Stewart is extensive and has a staff that includes biologists and field technicians, some of which is provided by contract support. The ITAM program staff are located within Range Division of the Directorate of Training. Organizationally, the ENRD has responsibility for the overall natural resources management whereas ITAM is responsible for specific projects related to training (LRAM and LCTA). In the past, it has not always been clear which projects are the responsibility of the ITAM program and which are under the ENRD. However, both ITAM and the natural resources staff meet on a regular basis to discuss and coordinate upcoming projects. There is still a sense, however, that the natural resources managers are at somewhat of a disadvantage because they are farther removed from the Garrison Commander than the ITAM program. The natural resources managers do not have the opportunity to directly brief the Garrison Commander and while command may have a fair understanding of endangered species compliance issues, it is felt that ecosystem management is not appreciated or understood.

Funding and Staffing

In addition to the Operation and Maintenance funding, Fort Stewart natural resources-related projects are supported by hunting and fishing fees and a reimbursable forestry program. These sources of funds are relatively stable and the natural resources program can be considered fully funded. Much of the Operation and Maintenance support funding is for compliance with the Endangered Species Act, particularly for RCW compliance management and reporting. Training land restoration (LRAM) and monitoring training lands (LCTA) are funded through ITAM, which also funds ITAM staff salaries.

Net proceeds from timber sales support reimbursable expenses related to the forestry program. This includes foresters' salaries, equipment, expenses related to timber sales, and forest management projects. The overall contribution of forestry funds to forest resources management at Fort Stewart is typically significant. However, there is no equivalent funding support for natural resources projects. Salaries for the natural

resources staff are funded through Operation and Maintenance dollars, as are the natural resources projects. Threatened and endangered species compliance management is funded as Class I “must fund,” whereas most ecosystem management projects are difficult to fund as they are classified as Class III for Operation and Maintenance purposes. In the past, the disparity between the support for forest management staff and projects and natural resources staff and projects has lead to difficulties in implementing ecosystem management initiatives; however, the recently completed INRMP has integrated forest management projects with the installation’s overall natural resources management.

The natural resources program is well staffed, as is the forestry program. However, there is a concern that Fort Stewart may have difficulty in retaining talented young staff. Fort Stewart natural resources staff have a range of technical qualifications and expertise. However, new staff to Fort Stewart require considerable on-the-job training particularly related to the military mission and military training needs. Once trained, these highly qualified staff are being attracted to better paying positions, especially land management and natural resources management positions within other federal agencies. The relatively low pay and limited career development opportunities at installations makes it difficult for installations like Fort Stewart to compete and retain these talented staff.

Communication/Coordination/Partnering

The organizational status of the natural resources program means that there are limited opportunities for the staff to interact directly with some installation groups concerning ecosystem management and INRMP implementation. Briefings to the Garrison Commander and other senior leadership on these topics are not given by the natural resources staff but rather are given by the DPW or by the ENRD chiefs. While issues like compliance with the Endangered Species Act are relayed to command and their importance is well understood, the topic of ecosystem management and its relevance to range and installation sustainability in both the short and long term is not well articulated to command. The process of developing the INRMP did set the basis for some improved communications by bringing some issues and concerns to the fore. The integration process of the INRMP has resulted in some installation groups (e.g., natural resources, forestry, range division) working more closely and cooperatively. For example, the natural resources staff meets regularly with Range Division to go over upcoming projects.

Fort Stewart has an installation-wide Geographic Information Systems database. The GIS fully integrates the natural resources management data with the rest of the installation (i.e. planning division, trainers, etc). The GIS can be access by all installation personnel, and each office is responsible for updating their data layers and information. The GIS database has helped improve communication and coordination throughout the installation.

Communicating and partnering with groups off post is challenging. Although close to the city of Savannah, Georgia, there are no local or regional groups with a common interest

in land management. The Savannah and Georgia coast are popular tourist and resort areas and much of the land surrounding the installation is comprised of farms. As a result, it is difficult for Fort Stewart to identify potential partners with an interest in land or ecosystem management. There is a sense that when the installation is looking to coordinate with outside groups, these groups have more of a sense of what can Fort Stewart provide them, rather than what might be achieved jointly with Fort Stewart. To date, the DPW does not participate in local off-post planning meetings and discussions in spite of concerns about urban development up to the installation's boundaries. This is an area that has not yet been addressed by the installation's master planning but which should be considered as part of ecosystem management.

The ENRD has its own public relations staff person to inform and educate the public on environmental issues. The public relations staff person coordinates ENRD activities such as Earth Day and also looks for interesting articles and stories for publication and distribution. The installation's Public Affairs Office does not typically provide support to ENRD on environmental or natural resources related issues.

Although there has been limited success in identifying public groups as potential partners, Fort Stewart has been successful in working with grammar schools in the area, and members of the public participate on the recovery teams that deal with threatened and endangered species issues. The installation also hosts public events throughout the year such as the Weekend for Wildlife and Earth Day.

Fort Stewart is an active partner in RCW recovery. The success of the installation's RCW management has allowed the installation to provide fledgling RCWs to other regions of Georgia and Florida to assist in regional recovery of the species. Fort Stewart natural resources staff participates regularly in the regional RCW recovery efforts.

Other Challenges

Fort Stewart is in an area of the country where vegetation communities are maintained through natural fires and burning. The installation has a prescribed burn program to support the military mission, for ecosystem management, for RCW habitat restoration/enhancement, and for fuel reduction. However, there are several challenges and conflicting issues facing Fort Stewart concerning prescribed burns, not the least of which are liability, smoke generation (the installation borders a major interstate highway), and safety. Concerning the specifics of burning, the installation managers are faced with conflicting requirements for the locations, acreages, and timing of burns. The U.S. Fish and Wildlife Service has established very specific management requirements for the RCW, including a three-year burn cycle regardless of other conditions. Adaptive management during the drought conditions that Fort Stewart has had for the last few years dictates a burn cycle of four years with preference to growing season burns. The drought conditions have made burns very difficult to accomplish but they are still on a three-year burn rotation because of U.S. Fish and Wildlife requirements. These imposed burn cycles do have some negative effect on overall timber quality, so there is some conflict with desirable forestry conditions. When trying to balance all these conflicting issues, the natural resources managers must keep in mind the need to maintain the

training lands and ranges so that the military mission is minimally affected. The specific management requirements concerning the RCW also are in conflict with some of DoD's Principles of Ecosystem Management. For example, RCW habitat takes precedence over other, potentially more broadly beneficial habitats, and it is likely that the installation's overall biodiversity is limited by the emphasis on RCW habitat. The Fort Stewart staff would like guidance on how to interpret such conflicts between U.S. Fish and Wildlife policy and DoD ecosystem management policy.

The natural resources managers understand that by pursuing ecosystem management at Fort Stewart, the appearance of the landscape will eventually change. When the installation was established, much of the area was under small farming operations. With the arrival of the Army, most of the land was developed for forestry. The majority of the pine on Fort Stewart has reached its optimum for harvest purposes and the installation foresters are working as quickly as possible to reduce the volume of standing timber. With the de-emphasis on forestry and the emphasis on ecosystem management, there will likely be changes that will affect the local economy. On post, there may be a reduction in the size of the forestry program as the optimum stocking levels are achieved, with a concomitant reduction in the amount of funds the local counties receive as State Entitlements from the sale of Army timber. A reduction in timber sales may also impact the local economy of the logging companies (some of which are small family-owned operations) and sawmills. While these changes may not be dramatic and will be relatively slow to occur (estimated at ten to twenty years), the natural resources staff feel that it is important to educate both installation and off-post groups about the anticipated change to the landscape as ecosystem management becomes fully implemented.

B. TINKER AIR FORCE BASE

Installation Background

Tinker Air Force Base's (AFB) history began in 1940 when a group of Oklahoma City civic leaders and businessmen learned that the War Department was considering the central United States as a location for a maintenance and supply depot. On 8 April 1941 the order was officially signed awarding the depot to Oklahoma City.

The base, an Air Force Materiel Command installation is a multi-service installation named in honor of Major General Clarence L. Tinker who fought in World War II. Located about nine miles southeast of downtown Oklahoma City, Tinker AFB covers over 5,000 acres, and includes the Oklahoma City Air Logistics Center (OC-ALC). The Tinker AFB mission is "...dedicated to providing worldwide technical logistics support to Air Force aerospace weapon systems, equipment, and commodity items, and encompasses a myriad of responsibilities".

Through World War II Tinker's industrial plant repaired B-17 and B-24 bombers and fitted B-29s for combat. During the Korean conflict, it maintained a steady supply of aircraft and materiel that were needed in the Far East. The plant later played a key role in the Berlin and Cuban crises and in the Vietnam War.

Today, Tinker AFB supports a working population of approximately 22,000 military and civilian employees who perform logistics and servicing work. The OC-ALC, the largest organization on Tinker AFB, is the worldwide manager for a range of aircraft, engines, missiles and commodity items. Tinker also accommodates two large Air Combat Command (ACC) support units and is home operating base for the 552nd Air Control Wing flying the E-3 Sentry, the Air Force Reserve's 507th Air Refueling Wing, and the Navy's E-6A Strategic Communications Wing One.

Tinker AFB is a primarily industrial installation in an urban/suburban setting. Of the 5,000 acres, approximately one-half (2,620 acres) of the land area is highly developed with buildings, roads, and other paved areas. About 700 acres are high maintenance grounds such as lawns, sports fields and a golf course. Periodically maintained grounds make up 1,036 acres (e.g., airfield). The remaining 684 acres are relatively unmaintained: they consist mostly of leased clear zones/training areas and the base Urban Greenway, a natural and park-like recreational area with multi-use trails, ponds/marshes, wooded bottomland, and a remnant native prairie.

Historically the area appears to have been covered by tall and/or mixed grass prairie with trees and shrubs occurring almost exclusively along water courses and draws. Today, no appreciable areas of completely undisturbed presettlement vegetation exist on the base. A small (i.e., ten acres) relatively undisturbed remnant native mixed grass prairie is located in the southwest corner of the installation. All other vegetation on base property has been moderately to heavily disturbed. Some small populations of the Oklahoma Penstemon (*Penstemon oklahomensis*), a rare plant, are found in grassland and urban/industrial vegetation types on the base. Base fauna also has been

significantly altered since presettlement times. Four jurisdictional wetlands, numerous man-made ponds, and four creek systems comprise the base's main water features. On- and off-base groundwater is expansive. Past surface and groundwater contamination has resulted in the base being designated a National Priority List (NPL) site.

The base Environmental Management Directorate has primary responsibility for overseeing implementation of ecosystem management on Tinker. This is accomplished mostly through the Directorate's natural resources program. Between 1982 and 2001, the natural resources program was staffed with one to seven personnel. However, recently the Directorate underwent the commercial activities A-76 process and this resulted in reducing the number of natural resources staff while simultaneously increasing responsibilities. Today, staffing consists of a natural resources manager, a biologist, and two laborers. The staff is often augmented with seasonal laborers.

Case Study Analysis

Since Tinker AFB is a large industrial complex surrounded by urban and suburban development, it is best classified as an urban ecosystem. Currently, the base does not have any federally listed threatened or endangered species but does have federal and state species of concern.

Vision/Goals/Objectives

Ecosystem management on and around Tinker AFB is very complex. Most land areas on and directly adjacent to the base are densely populated and highly disturbed. Ecosystem integrity has been severely degraded and in most cases is irreparable. Even in areas that may initially appear to be recoverable (e.g., conversion of exotic Bermuda grass/fescue vegetative cover to native mixed grass prairie on 600 acres of the airfield), the aircraft flying mission frequently precludes such actions. In this particular example, the potential for bird aircraft strikes involving large raptors and other birds increases with native grass cover, thereby making it an infeasible management action.

However, within these constraints many ecosystem management principles are being applied where practicable. This is facilitated by Tinker's Integrated Natural Resources Management Plan (INRMP) that was approved in August 1999. The INRMP clearly states the natural resources program's overall mission, vision, and goals for six specific management areas (i.e., fish, plants, water, wildlife, people, soil). These are summarized by the natural resources manager as follows:

Mission: Put and end to substandard stewardship of natural resources, thereby providing a healthy ecosystem accessible to the needs of the military and surrounding community.

Vision: Create and maintain a program with strong volunteering and partnering that provides outdoor recreation opportunities unmatched for an industrial installation. Also provide a clean, healthy ecosystem that maintains a safe aircraft flying environment and supports all aspects of the military mission.

Goals: Tinker has established specific goals for seven natural resources areas. They include:

- Fish – Establish and maintain high quality, sustainable sport fisheries and stable non-game fisheries.
- Plants – Develop and manage the natural and urban landscape to provide a safe, attractive, functional, maintainable, and ecologically sound environment, which is in character with the Central Oklahoma/Texas Plains Crosstimbers ecoregion.
- Water – Using a watershed management approach, provide for water conservation, water quality, and flood control.
- Wildlife – Establish a healthy native wildlife community that provides recreation opportunities and reduces human wildlife conflicts.
- People – Promote community-wide (on- and off-base) involvement in the natural resources program, focusing on a common vision and facilitating active participation from all who use, value, and influence base natural resources.
- Soil – Protect, restore, and wisely use our soil resources.
- Program Management – Manage the natural resources program to promote an effective, efficient, economical, and customer-oriented public service.

Tinker AFB uses a supplemental annual action plan to detail specific management actions for each management area. Some ecosystem management actions initiated/accomplished under the current INRMP includes establishing a base standard for native biodiversity by adopting a regional ecoregion designation as proposed by the Oklahoma Biodiversity Task Force; completing numerous projects emphasizing native species, restoration, and landscaping; managing beyond base boundaries; and providing sustainable multiple uses.

Although the Annual Action Plan has a clear objective to establish metrics to facilitate monitoring progress towards INRMP goals, this currently is not in place and base natural resources projects are not adequately monitored. There are no benchmarks in place from which to measure changes and make management adjustments. For example, natural resources staff would like to monitor vegetation changes in the prescribed burn area. However, monitoring is a Class III project and therefore gets low priority for funding.

Installation Organization

The placement of the natural resources program within the base organizational structure has varied over the years. A natural resources program was staffed for the first time in the early 1980s and was located in Civil Engineering. In 1985, the Environmental Management Directorate (EM) was established as a separate temporary directorate. In 1988 EM became permanent and inherited the natural resources program. EM houses three divisions, one being the Environmental Restoration Division (EMR). The natural resources program is one of five programs located in EMR.

Since its inception, the natural resources program's location in the EM organizational structure has not been conducive to effective ecosystem management. For example, although water is a natural resource, primary management oversight for this resource is done by another branch under another authority. Likewise air and groundwater management programs are accomplished by other divisions in another line of authority. The primary mission of EM is to protect the environment (i.e., natural resources) consistent with the military mission; therefore, one would expect natural resources to be the umbrella over all other environmental programs. However, this is not the case—natural resources management is a separate ancillary program. It has been suggested that if natural resources management were used as the overarching directorate-level framework for environmental management, effective ecosystem management would be much more likely to be achieved.

Funding and Staffing

Due to a reduction in funding in recent years, Tinker natural resources staff has investigated numerous new sources of funding and support. They have found creative ways to implement some INRMP projects.

In 1999 Tinker received a grant from the Oklahoma City Community Foundation to landscape with native plants. Also, a cooperative agreement with the Tree Bank in Oklahoma City fostered the development of a 2,000-plant tree farm. Natural resources staff partner with local off-base organizations to get these trees planted on- and off-base at minimal cost. Since purchasing trees is considered a Class III project and would have little chance of being funded, the tree farm has allowed Tinker's natural resources staff to plant native trees that otherwise would not have been possible.

Restoration and compliance funds have also been used to indirectly benefit the natural resources program. For example, as part of a restoration project clay was excavated from on-base borrow sites to cap landfills. Afterward the borrow sites were developed into ponds and marsh areas creating desirable habitat.

Another means by which the natural resources staff have been effective in implementing ecosystem management, is by acting in an advisory capacity to other installation groups and tenants. They advise these groups on effective use of resources that will enhance natural resources management. For example, the natural resources staff provided guidance to golf course staff in planting native grasses. The natural resources program would not have had the funding or manpower to perform this project; however, working with the golf course maintenance staff facilitated the project's completion.

Staffing levels have been less detrimental to the natural resources program than funding. Numbers of EM personnel have varied over the years from less than five in the early 1980s to over 100 in the early 1990s. As previously mentioned, natural resources staff has varied from one to seven over the same time period. Currently, there are approximately fifty-five EM staff, four (excluding one half time employee) of which work

in the natural resources program (natural resources manager, a biologist, and two laborers).

Staffing levels do not seem to be a major challenge at Tinker in meeting the current level of ecosystem management on the base; however, the recent A-76 process has increased the responsibilities of the manager and biologist. Furthermore, it is believed that a considerably larger staff would be necessary to fully and effectively implement ecosystem management on and adjoining Tinker Air Force Base. Alternatively, it is believed the previously described umbrella approach (Para. 1.2.2) to installation natural resources management can fully and effectively implement ecosystem management without a larger staff. This approach will be effective if the natural resources staff role as advisor and planner are seen and accepted by the base organizations. However, the current organizational structure does not support this approach.

Communication, Coordination, and Partnering

An impediment to implementing installation-wide ecosystem management is the lack of communication with other base programs and staff. For example, the natural resources program currently is not briefed at quarterly Environmental Safety and Occupational Health (ESOH) meetings. Being briefed at the ESOH meetings has been identified, however, as an objective in the INRMP. NR staff also lack a role on the Community Advisory Board. The A-76 process has further impacted the ability to communicate and coordinate with other groups on base. As government organizations and services have been contracted, communication and coordination have often become difficult and ineffective.

Tinker's INRMP is integrated with the master plan and integrates most of the natural resources programs. However, various operations remain which are not adequately integrated. Golf course pest and fertilizer management and water issues are dealt with by golf course maintenance and EMC, respectively. Ideally, these would be fully integrated with the natural resources plan and under the responsibility of the natural resources program.

A goal of the natural resources staff to improve communication and coordination is to develop an installation-wide database that is accessible by all base organizations. Currently, Tinker's natural resources staff has a standalone Geographic Information Systems. Most other base organizations use CAD (Computer-Aided Design). Although the natural resources GIS system and base CAD system are not currently integrated, steps are being taken to develop such applications. By integrating the entire base, data would be shared and time and money would be saved through better coordination.

There is little off-base involvement in ecosystem management. Stakeholders were not involved in the development of the INRMP; however, there are plans for involvement during implementation. Tinker's lack of ecologically significant natural resources, such as endangered species and pristine mixed grass prairie, results in little interest from the local community. Therefore, acquiring stakeholder involvement is difficult.

Tinker's natural resources staff does partner to implement some ecosystem management projects. For example, the base partnered with the US Fish and Wildlife Service, the Natural Resources Conservation Service, and four area communities/institutions to mitigate wetland losses on the base. The INRMP has identified partnering as a primary means of implementing Plan goals and objectives.

Education and Training

Continuing education and training for the natural resources staff are supported at Tinker AFB. The natural resources staff is well trained through education, conferences, and workshops and has acquired their knowledge of ecosystem management from such activities. Training has allowed the natural resources staff to remain up to date with techniques and management practices. The staff actively pursue and participate in these activities.

C. U.S. ARMY ARMOR CENTER AND FORT KNOX

Installation Background

The U.S. Army Armor Center and Fort Knox is located in north-central Kentucky, 31 miles south of Louisville. It encompasses approximately 109,054 acres and has a working population of about 29,780. It is a Training and Doctrine Command (TRADOC) installation with a primary mission to train soldiers for the armored force. Training includes tank maneuvers, live weapon firing, and aviation training.

During World War I, an artillery-training center was established in the area that is now Fort Knox. From 1922 through 1932, the area was used primarily as a training center for the 5th Corps, reserve officers, Citizens Military Training Camps, and National Guard. In 1925, the area was designated as Camp Henry Knox National Forest. This status was terminated in 1928 when two infantry companies were assigned to the Camp. In 1931, the first elements of the armored force came to Camp Knox for testing. Congress designated Camp Knox as a permanent garrison in 1932 and renamed it Fort Knox. Since the early 1940s, Fort Knox has remained the site of the Armor Center and School and its full title is the U.S. Army Armor Center and Fort Knox.

The Fort Knox area has a temperate, continental climate of the dry, sub-humid type. The topography of Fort Knox ranges from flat, alluvial floodplains along rivers to rugged knobs and broad ridge tops, narrow valleys, and steep to sloping cliffs. Bottomland along rivers and creeks is level to gently sloping. Most of the installation lies within a rolling to hilly landscape with karst topography. There are intermittent sinkholes, outcropping knobs, narrow steep ridges, sinking streams, and caves.

Just two decades ago, the condition of Fort Knox training lands was generally degraded. Harmful practices such as clear-cutting trees, overuse of training lands, a lack of land restoration, in-field washing of vehicles, and a limited environmental awareness of the trainers and soldiers in the field led to land erosion, stream sedimentation, and ecological problems. Over the last twenty years there had been much improvement in land conditions and practices at Fort Knox. Much of the past improvement could be credited to a strong ITAM program that, when fully funded, implemented environmental protection and restoration projects such as hardened water crossings and stream restorations and provided an increased environmental awareness for the trainers and field soldiers. Through the efforts of a strong ITAM program and skilled professional environmental staff, over 3,000 acres of training lands were successfully restored. However, Fort Knox seems to be entering another phase of deterioration of the training areas. Reductions in the ITAM program have all but eliminated land maintenance and restoration projects and this has led to renewed erosion and sedimentation problems. Use of the ranges for training has not been as heavy as in past decades, which has helped limit the extent of deterioration, but the general trend in land quality and ecosystem health appears to be downward.

Case Study Analysis

Fort Knox is representative of a large installation with training impacts. Several federally listed endangered animal species as well as state listed endangered, threatened, and special concern animal and plant species are found on base.

Vision, Goals, and Objectives

The current INRMP was completed in February 1998 and covers the years 1998-2002. The INRMP broadly supports the principles of ecosystem management. It contains explicit goals and objectives for EM. For example, the forestry and wildlife management components support sustainable management of those resources. Specific activities necessary to achieve the goals and objectives are outlined and prioritized in the INRMP. Although the goals and objectives and associated activities for ecosystem management are clearly expressed, the INRMP is not being fully implemented due to organizational and funding constraints (see below).

The 1998-2002 INRMP was updated for 2001-2005 and has been provided to and reviewed by both the U.S. Fish and Wildlife Service and the Kentucky Department of Fish and Wildlife. Both agencies have concurred with the document. An area where the INRMP was updated is in directing the conversion and reversion of the forest to more ecologically desirable forms using timber stand improvement methods. The much-reduced management of the forested areas in recent years due to accessibility problems has meant that the forests are not progressing to the desired goals and objectives.

Areas where goals and objectives are being pursued include threatened and endangered species management, and in the recreational fishing and hunting programs. Threatened and endangered species management is compliance driven and is therefore less susceptible to funding limits. The recreational fishing and hunting programs are significant sources of revenue for the installation through fees and permits, and these programs also contribute significantly to positive public relations.

Installation Organization

The Environmental Management Division (EMD) has primary responsibility for the implementation of ecosystem management. EMD is within the Directorate of Base Operations Support (DBOS). DBOS includes other divisions such as Plans and Programs, Equipment Maintenance, Engineering and Services, and Facilities Operations and Maintenance. DBOS reports to the Garrison Commander, who reports to the Deputy Commanding General, who reports to the Commanding General. The natural resources staff is within EMD and comprises wildlife biologists, forester, environmental specialist, and technicians. The installation has a dedicated LRAM Coordinator housed within EMD with an ITAM Coordinator housed in Range Division. These staff work concurrently on ITAM program issues.

The Range Division is housed within the Directorate of Plans, Training, and Mobilization (G3), which reports to the Chief of Staff and the Commanding General. Range Division

is charged with the control, maintenance, development, and stewardship of all the training lands of the installation. As such, Range Division should play a key role in ecosystem management of the training lands. The Range Division also has primary responsibility for implementing the ITAM program, which is designed to monitor the quality of the lands, promote environmental awareness among the land users, prevent damage to lands, and repair damaged lands. However, the absence of funds for the ITAM program over the past several years has meant that Range Division has not been able to fulfill its ITAM responsibilities.

The separation of EMD and the Range Division functions and the relative hierarchical distances the two offices are from a common authority have a negative effect on ecosystem management implementation. Range Division is four levels removed from the Commanding General (Range Division – G3 – Chief of Staff – Commanding General), while the EMD is five levels removed (EMD – DBOS – Garrison Commander – Deputy Commanding General – Commanding General). The EMD's distance from the Commanding General makes it difficult to communicate the needs of ecosystem management and to gain support for the program. As an example, the INRMP directs that rest and rotation of training lands is a necessary management practice to allow recovery of the training areas and to permit routine forest management and land restoration. However, the natural resources program has not been successful in gaining support for rest and rotation of the training lands. The absence of these land management activities appears to be exacerbating the deterioration of the land condition from an ecosystem management perspective, if not from a range sustainability perspective.

Funding and Staffing

Because the majority of Fort Knox is either training or range (impact) lands (over 50,000 acres of the 109,054 acres), the installation's overall ecosystem management relies to a considerable degree on an active ITAM program. Many of the land management activities outlined in the INRMP – especially those related to erosion and sediment control, monitoring, and land restoration – were intended to be accomplished through the joint efforts of the ITAM and natural resources programs. However, the Range Division's ITAM program has not been funded in recent years and ITAM projects are currently idle. This is an impediment to implementing ecosystem management at the installation. The estimated budgetary requirement for the ITAM program is about \$2 million per year; however, ITAM funding requests in recent years do not reflect this. ITAM funding requests are kept more in line with the anticipated available funding rather than with what may actually be needed in a given year. It is expected that the program may receive about \$300,000 for fiscal year 2002. As a TRADOC installation, Fort Knox is not alone in experiencing ITAM funding shortfalls.

The lack of ITAM funds at Fort Knox means that the INRMP, and its ecosystem management goals and objectives, have not been fully implemented. Using the limited Operations and Maintenance (O&M) funds, EMD does what it can on the training lands to minimally comply with requirements. This use of O&M funds and the EMD staff support means that to a certain degree, these resources are not available to support

other ecosystem management initiatives. The natural resources staff feels that they operate in more of a “fix-it” mode and have little opportunity to be proactive.

Fort Knox receives considerable revenues from its recreational fishing and hunting programs. These revenues support the installation’s fish and wildlife management programs. Although Fort Knox has commercially valuable forest resources, there is no reimbursable forestry program on the installation. The Range Division does not consider forest management activities compatible with the training mission and so there is no opportunity to benefit financially from installation timber sales. Also, because Fort Knox is a non-contributor to DoD’s Forestry Reserve Account, the installation may be at a disadvantage when applying to the Forestry Reserve Account for support.

Fort Knox lacks sufficient staff to implement ecosystem management, but in the absence of sufficient funding, it is not clear how much benefit additional staff would bring if there is no concomitant increase in funding to support ecosystem management projects. NEPA compliance requirements also lack support and funding. Since about 1994, the number of NEPA compliance activities, such as environmental assessments and impact statements, has grown significantly at Fort Knox. Most of the NEPA activities are conducted using EMD staff support. The growth in NEPA activities has had a positive effect by raising awareness for ecosystem management and for general environmental protection issues. However, the increased NEPA workload has not come with additional personnel or funding support. As a result, NEPA activities compete with the primary responsibilities of the EMD staff. This has lead to a sense of being overworked and overwhelmed.

In comparison to several years ago, the ITAM program also lacks staff support for ecosystem management. There is a relatively newly designated installation ITAM Coordinator; however, that individual also manages the Mounted Urban Training program. With attention split between two jobs and a lack of ITAM funding, it is not clear how effective the ITAM coordinator can be in reestablishing a working ITAM program.

Just as problematic as a lack of staff is the lack of support for the natural resources program from critical levels of the organization. Issues and activities facing command and staff at Fort Knox tend to be relatively near term, and personnel are rewarded for their abilities to address these issues quickly. Ecosystem management, on the other hand, is fundamentally long term. The divergence of these temporal frames makes ecosystem management difficult.

Communication, Coordination, and Partnering

Fort Knox has had success with external communication, coordination, and partnering. EMD personnel at Fort Knox have built strong working relationships with other government entities, and they maintain an open door for input from non-governmental organizations and private citizens. Fort Knox EMD has partnered with organizations to implement several monitoring efforts to measure the conditions of natural resources on the installation. Eastern Kentucky University and the U.S. Fish and Wildlife Service help Fort Knox with biological surveys. The U.S. Geological Survey assists the installation

with water surveys. Other partners include the Natural Resources Conservation Service, the Kentucky Department of Fish and Wildlife Resources, the Kentucky State Nature Preserves Commission, and the Kentucky Division of Forestry.

To facilitate relationships with private citizens and non-government organizations, Fort Knox has created the Fort Knox Core Community, the primary structured forum for interface between the installation and its neighbors. The former Chief of Staff of Fort Knox leads this forum and acts as the main liaison.

Interaction with stakeholders also occurs through mandated public meetings, such as those conducted under the public scoping and public review components of NEPA. The Sierra Club, for example, has participated in public meetings concerning the development of the Environmental Impact Statement for the proposed Northern Training Complex. Another local stakeholder who has interacted with the installation is The Nature Conservancy. Private citizens have not widely participated in the environmental activities or decision making of the installation. Rather, private neighbors find that the most important impacts of Fort Knox are its economic impact and its recreational hunting and fishing activities. The relative lack of interest by private citizens in Fort Knox may be due to the lack of any environmental crisis demanding attention. However, the EMD staff is anticipating an increase in interest from private citizens because of the changing demographics of the region. Fort Knox, which has enjoyed a rural setting, is becoming surrounded by residential development and its supporting commercial development as people relocate from the Louisville area.

A fundamental challenge facing Fort Knox's ecosystem management is the lack of funding for ITAM and the division of responsibilities and authority for the ranges. The EMD is responsible for ecosystem management of the installation's lands, but the Range Division holds managerial authority over land used for training. Range Division is the primary user of the lands and the most significant source of environmental impacts, but the EMD is ultimately responsible for the ecological condition of the training lands and ranges. Thus, the EMD is responsible for ecological conditions that they do not totally control. Range Division's cooperation is therefore necessary for successful ecosystem management. Coordination between EMD and the Range Division includes daily coordination on hunting and fishing activities, as well as coordination on ITAM projects and NEPA actions.

The number of training exercises that must be accommodated and the relatively limited area available for training further challenge the ability of the managers to successfully implement ecosystem management. In addition to Fort Knox's brigade training, the installation supports Reserve Officer Training Corps (ROTC) during the summer months and Army National Guard weekend training. As a result, there is limited access time available to accomplish routine management activities.

One of Fort Knox's EMD initiatives to improve ecosystem management implementation and communication is the development of a Geographic Information Systems database. Under the ITAM program, a full-time GIS analyst is currently on staff. The GIS analyst is housed in EMD to provide support to both the LRAM and ITAM coordinators, and to the

DBOS GIS Section. The objective is to consolidate installation information from range management, natural resources management, and facilities management activities within DBOS. The GIS analyst receives support through the ITAM GIS Regional Facility at Fort A. P. Hill in Virginia. As data are collected, they are made available to all management staff at Fort Knox.

D. NAVAL BASE VENTURA COUNTY POINT MUGU

Installation Background

Located 65 miles northwest of Los Angeles, in Southern Ventura County on the California coast, Naval Base Ventura County (NBVC) Point Mugu covers about 4,600 acres. The area that is now NBVC Point Mugu supported a relatively dense Native American settlement until the late 1700s. During the 1800s and 1900s, the surrounding area was used for ranching and agriculture. Duck clubs were developed in the 1920s and 1930s. Currently, NBVC Point Mugu is primarily surrounded by agriculture and open space, including the two duck clubs to the northwest, with Point Mugu State Park and the Santa Monica Mountains National Recreation Area to the east.

NBVC Point Mugu has been under the control of the military services for years but did not become a Naval base until 1945. Originally called Naval Air Warfare Center Weapons Division Point Mugu (NAWCWPNS), the base was consolidated with Naval Base Port Hueneme to form Naval Base Ventura County in October 2000. The consolidation, which started in 1998, resulted from a push to regionalize the Naval bases in the area to reduce costs. This move included consolidating the aviation mission and base operating support for both bases under a single command. Over forty tenants, including representatives of foreign nations, reside at NBVC Point Mugu, including the Naval Air Warfare Center (NAWC), numerous naval squadrons, 1st Naval Construction Regiment, 31st Naval Construction Regiment Headquarters (NCR), Construction Battalion Center (CBC), and Defense Automation & Production Service (DAPS).

Over half of the acreage of NBVC Point Mugu is saltwater marsh wetland (2,600 acres). Six and a half miles of relatively pristine beach habitat and Mugu Lagoon are also part of the acreage. Calleguas Creek, the drainage point for the surrounding watershed, flows into Mugu Lagoon. This estuarine environment has become critical for wildlife due to intense development in the surrounding region and the consequent loss of wetlands. A variety of wading birds, waterfowl, and harbor seals (*Phoca vitulina*) depend on Mugu Lagoon for breeding, feeding, and roosting. NBVC Point Mugu has six federal and state threatened and endangered species including five birds and one plant (California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus*), light-footed clapper rail (*Rallus longirostris levipes*), brown pelican (*Pelicanus occidentalis*), Belding's savannah sparrow (*Passerculus sandwichensis*), and salt marsh birds-beak (*Cordylanthus maritimus* ssp *maritimus*)). Loss of regional wetland habitat is the primary factor in their decline. Because Calleguas Creek drains into Mugu Lagoon and brings with it the drainage from the surrounding communities and agricultural fields, Mugu's natural resources program and management of the lagoon and estuarine environment are increasingly important.

Much of NBVC Point Mugu's natural resources projects revolve around maintaining and restoring saltwater marsh wetland and beach habitat for the endangered and threatened species. Stewardship of the lagoon is a high priority in NBVC Point Mugu's natural

resources program, and access to the wetlands, beach, and lagoon is severely restricted. The natural resources program has undertaken six wetland restoration projects since 1995, resulting in a total of 23.5 acres of tidal mudflat, sandflat, channels, ponds, salt marsh and sand islands. Mitigation plans have been developed for restoration of a 37-acre site to predominantly salt marsh. The restoration is currently underway and if completed would result in a mitigation bank for NBVC Point Mugu.

Case Study Analysis

NBVC Point Mugu is representative of a small base with extensive missile and aircraft testing in a sensitive coastal environment with six endangered and threatened species, five of which are birds.

Vision, Goals, and Objectives

The natural resources program at NBVC Point Mugu has a clear vision for ecosystem management on base, and this vision does extend beyond the installation boundaries. Because of the base's wetlands and beach habitat types, NBVC Point Mugu is viewed as providing critical habitat for avian species migrating in the Pacific Flyway. However, there are few local initiatives to develop a regional ecological vision for the area surrounding NBVC Point Mugu. NBVC Point Mugu is surrounded by a patchwork of agricultural fields and development. Therefore, NBVC Point Mugu's role in regional ecosystem management is limited. NBVC Point Mugu's goals and objectives are limited to the management of beach, salt marsh wetland, and lagoon habitat within the installation boundaries. The goals and objectives will be documented when the NBVC Point Mugu INRMP draft is finished.

Calleguas Creek Watershed Task Force and Ormond Beach Task Force are two initiatives to develop regional ecosystem management plans surrounding NBVC Point Mugu. The Calleguas Creek Watershed is approximately 30 miles long and 14 miles wide, with a drainage area of approximately 343 square miles. Currently, surface water flow is discharged to Mugu Lagoon through Calleguas Creek. A second regional effort is the Ormond Beach Task Force. This group, composed of the Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), California Coastal Commission, California State Coastal Conservancy (Coastal Conservancy), and regional and local governments (City of Oxnard), Southern California Edison (SCE), and nonprofit conservation organizations, has expressed concerns about a large number of sandy beach as well as wetland related issues. Although the head of the Environmental Division attends some of these meetings and sits on some committees, Point Mugu's natural resources manager does not. The natural resources manager is also not briefed on the status of the initiatives.

Installation Organization

The Environmental Division is located in the Public Works department of the installation organizational structure. The Environmental Division is divided into two branches—Environmental Protection Branch and Environmental Compliance Branch.

The natural resources program is one of eight program areas under the Environmental Protection Branch. The natural resource manager is the only full-time staff. The second division, the Environmental Compliance Branch, houses several other environmental programs.

Since the early 1990s, the head of the Environmental Division has had a direct line to the base commander. This line of communication has been crucial in managing the entire Environmental Division. However, it may not be feasible for the head of the division to adequately address each of the many programs within the Environmental Division, in turn hindering the funding, understanding, and acceptance of ecosystem management.

Funding and Staffing

The NBVC Point Mugu natural resources manager has been successful in acquiring help from universities on research and restoration projects to partially offset the staffing and funding issues.

Most funding granted to the Environmental Protection Branch at NBVC Point Mugu is for the management of threatened and endangered species. Noncompliance projects may be delayed or cancelled because there is not enough money to support the requirements of the DoD's ecosystem management policy. Class I projects that are put forward in the budget do not always get funded at NBVC Point Mugu.

Projects within programs such as Bird Air Strike Hazard (BASH) pose a unique set of challenges to implementing ecosystem management. Examples of such projects might include removing telephone poles or installing bird deterrent devices on towers. Conflicting opinion on who is responsible (i.e., Public Works, natural resources program, grounds maintenance, Aviation Safety) for paying for such projects inhibits their implementation because funds are limited in all programs.

Staffing levels are also affected by funding limitations. Currently, the Environmental Division has twenty-three full-time civilian employees and two on-site support contractors. Of these employees, seventeen work at NBVC Point Mugu and six at NBVC Port Hueneme. There is only one full-time natural resources staff, the natural resource manager. The natural resources manager hired two on-site contractors (field biologists) from Engineering Management Concepts, Inc. Also, a professor from the University of Arizona has a cooperative agreement to assist the natural resources program with GIS data processing and analysis. Wetland restoration research and monitoring are performed by several University of California Los Angeles professors under a cooperative agreement. The field biologists are critical to managing the ecosystem at NBVC Point Mugu. However, the field biologists' salaries are equivalent to a GS-5 and they lack job security, so turnover is high. The natural resource manager needs to rehire and train technicians each time there is a vacancy. This lack of staff support for the natural resources program limits the abilities of the natural resources manager to perform ecosystem management. Lack of staff directly affects the ability to implement ecosystem management at NBVC Point Mugu because projects are unable

to be performed. There is also fear that contracting the natural resources staff will become the norm. Outsourcing has serious consequences for morale.

Communication, Coordination, and Partnering

Depending on the audience, the effectiveness and extent of communication of ecosystem management policy and natural resources issues varies. Communication directly between the commander and the natural resources staff is lacking, although the head of the Environmental Division does speak with the commander. As mentioned earlier, the size of the Environmental Division hinders an in-depth discussion of ecosystem management issues between the head of the Environmental Division and the commander. The ecosystem management responsibilities given to the natural resources manager necessitates a position of greater authority within the installation structure. This would facilitate communication, coordination, and implementation of ecosystem management on base.

The natural resource manager or field biologists communicate with the air traffic control tower when a potential conflict could arise between planes and birds. For example, information on the hours and seasons when bird traffic is at its highest and warnings when birds are on the runway is provided to the tower. However, this information is either not then forwarded to pilots and trainers or the information is ignored. Having over forty tenants, including foreign nations' military groups, also makes it difficult to effectively communicate and coordinate natural resource management issues and projects because of organizational constraints (the natural resources manager is a program area within the protection branch within the Environmental Division and tenants are far removed from this). Bird strikes are a serious issue for pilots. Information on bird hazards is not being communicated effectively and/or the pilots and trainers are not required to respect such warnings, which can lead to serious conflicts. The natural resources program is poorly understood and respected on base in general, possibly due in part to lack of communication.

The natural resources manager has good relations with local government agencies (i.e., USFWS) and data are exchanged regularly. The groups coordinate on mitigation and endangered species projects and issues. Partnerships are an essential component of successful ecosystem management. Successful coordination largely stems from free flow of data from the extensive Geographic Information Systems database the natural resources manager has developed at NBVC Point Mugu. The GIS tool increases communication on and off of base and can be used to brief the public and military staff and attract partners to assist the natural resources program.

The natural resource manager has also developed partnerships with universities and researchers. This enables the NBVC Point Mugu natural resources program to benefit from data and research without expending much if any funding and/or manpower. These types of partnerships are efficient ways to implement ecosystem management projects, since these projects may not be fully funded by NBVC Point Mugu.

One such project is the development of BIRD RADAR, bird radar apparatus, with Clemson University in South Carolina. The radar apparatus would be portable and provide the natural resources manager and pilots and their trainers accurate real-time information on bird movements near the installation. The benefits are significant. Mainly pilots and their planes would be safer and important data on bird migration would be acquired, greatly improving ecosystem management at NBVC Point Mugu.

Education and Training

Training requests for the natural resources staff are not supported. However, to the benefit of the program, the natural resources manager is knowledgeable and well trained in the fields of ecology and natural resources management. Much effort is made by the natural resources manager to network with colleagues to remain up-to-date on techniques and management regimes so the program does not suffer.

E. MARINE CORPS LOGISTICS BASE BARSTOW

Installation Background

The Marine Corps Logistics Base (MCLB) Barstow, California, was established as the Marine Corps Depot of Supplies in December 1942 when the United States Navy turned over the site to the Marine Corps. MCLB Barstow was used as a storage site for supplies and equipment during World War II. Following the war, the base outgrew its facilities and acquired its current land base by annexing 2,000 acres from the United States Army.

In March 1961, the importance of MCLB Barstow increased dramatically with the establishment of the Depot Maintenance Activity. In November 1978, the Base was re-designated to its present title of Marine Corps Logistics Base to emphasize its broad logistics support mission. MCLB Barstow supports Marine forces west of the Mississippi and in the Far East and Asia. MCLB Barstow provides support for maintenance, repair, rebuild, storage, and distribution of equipment and supplies.

The base is located in the Mojave Desert, three and one half miles east of the city of Barstow and 150 miles from Los Angeles, California. MCLB Barstow supports a working population of approximately 2,000 military and civilian employees. The base encompasses approximately 5,700 acres and is divided into three principle sites. The 1,569-acre Nebo site functions as the base headquarters and is the main facility for administration, storage, recreational activities, shopping, and housing functions. The 1,696-acre Yermo Annex is primarily a storage and industrial complex. The third site, approximately 2,438 acres, serves as the base rifle and pistol range. The rifle range contains most of the natural areas on base and is the primary site of ecosystem management activities, which are focused on the Mojave Desert ecosystem.

The Mojave Desert is located in southeastern California. The Mojave Desert climate is characterized by extreme variation in daily temperature and an average annual precipitation of less than 5 inches. Almost all the precipitation occurs in the winter. Summers are dry, hot, and windy.

The Mojave has a typical mountain-and-basin topography with sparse vegetation. The Mojave Desert hosts about 200 endemic plant species. Due to below freezing winter temperatures, cacti are rarely found in the Mojave. Cresote bush (*Larrea tridentata*) and bursage (*Ambrosia dumosa*) dominate the open-shrub community. Other plant species include desert holly (*Atriplex hymenelytra*), the Mojave yucca (*Yucca schidigera*), and catclaw acacia (*Acacia greggii*). The imported tamarisk (*Tamarix ramosissima*) now dominates the Mojave River drainage.

The fauna of major concern in this region is the federally threatened desert tortoise (*Gopherus agassizii*). MCLB Barstow's rifle range supports a population of seventy tortoises, or one tortoise per square mile. The major threats to the tortoise include vandalism, raven predation, disease, collection for pets, and habitat degradation. Other

fauna found at MCLB Barstow include coyote (*Canis latrans*), bobcat (*Lynx rufus*), kit fox (*Vulpes macrotis*), black-tailed jack rabbit (*Lepus californicus*), desert cottontail rabbit (*Sylvilagus audubonii*), common raven (*Corvus corax*), and a variety of bird and reptile species. The major management concerns at MCLB Barstow are the protection of the desert tortoise, participation in regional desert initiatives, and cultural resources management (e.g., petroglyphs).

Case Study Analysis

MCLB Barstow is representative of a small base with a high profile federally threatened species in a desert environment but with only limited training impact.

Vision, Goals, and Objectives

MCLB Barstow shares the regional vision of the Mojave Desert Ecosystem Initiative, a joint initiative between DoD and the Department of Interior (DOI) launched in 1994. The Desert Managers Group (DMG), created to implement this initiative, strives to work together to conserve and enhance the California desert for current and future generations. MCLB Barstow is a partner of the DMG. MCLB Barstow has clearly defined goals and objectives for ecosystem management in the INRMP. Although the goals and objectives in the INRMP are extensive, ecosystem management projects that are not related to desert tortoise compliance management are not implemented.

Baseline surveys have not been conducted for mammals, reptiles, or bird species and there is no ongoing monitoring for species other than the desert tortoise. A vegetation survey was conducted, but the data are unreliable because the survey was conducted in an exceptionally dry year when vegetation growth was sparse. The lack of baseline information and monitoring effectively limits adaptive management. For example, the non-native tamarisk (*Tamarix* spp.) is clearly out-competing native vegetation, but there have been no efforts to monitor and/or remove the tamarisk or other invasive species.

Installation Organization

The natural resources manager (NRM) at MCLB Barstow is located within the Environmental Division of the Installation and Logistics Department of the installation organization structure. Currently, MCLB Barstow's organization structure is undergoing restructuring that may establish the Environmental Division as an independent department. This would place the Environmental Division and the NRM higher in the installation hierarchy than under the existing organization structure.

The current NRM has a direct link to the commander and can communicate with the commander when necessary. This facilitates communication, project implementation, and funding for desert tortoise management. The proposed restructuring would most likely improve the lines of communication. The listing of the desert tortoise in 1990 was a factor behind the establishment of an enlarged and more active environmental program at MCLB Barstow. The desert tortoise helped make environmental compliance a high priority. Therefore, MCLB Barstow's NRM, unlike many installation NRMs, has

been able to communicate and coordinate on base effectively regardless of the organizational location of the natural resources program in the installation hierarchy.

Funding and Staffing

Since the inception of resources management in the 1990s, funding has not been a problem, but only endangered species compliance projects are budgeted. It is possible that funding would be a limitation if noncompliance projects (i.e., exotic species control and removal, migratory bird species projects) were budgeted.

The noncompliance projects are not budgeted because of lack of staff support. There is only one natural resources staff member at MCLB Barstow, and that staff position has responsibility for natural and cultural resources management at MCLB Barstow and participation in the regional desert ecosystem committees (i.e., DMG, DMG Science/Data Management Interagency Working Group, and Planning and Coordination of Installation Desert Environmental Resource Managers (PACIDERM)). Participation in the committees and cultural resources management by the NRM leaves little time for natural resources management at MCLB Barstow. The NRM has little time to perform noncompliance projects or supervise another staff member to perform noncompliance management activities. Although the committees are important to managing the Mojave Desert ecosystem, MCLB Barstow may not be benefiting from the groups directly.

The current NRM is nearing retirement, and it appears there is resistance at MCLB Barstow to replacing the NRM with another full-time natural resources position. Another staff member at MCLB Barstow who currently coordinates NEPA compliance may pick up the natural and cultural resources management responsibilities when the NRM retires. There is also resistance to hiring additional staff to assist with the overall natural resources program. Without enough qualified environmental professionals on staff (either natural or cultural resources), successful ecosystem management is greatly inhibited and compliance with ESA for desert tortoise management could be jeopardized. Overall, lack of staff at MCLB Barstow inhibits effective implementation of ecosystem management projects. The exceptions to this are compliance projects and partnerships related to the desert tortoise.

Communication, Coordination, and Partnering

Natural resources management activities and efforts for the desert tortoise are effectively communicated on site at MCLB Barstow. The MCLB Barstow staff pride themselves on having a good level of communication and an acceptance of the management requirements. The head of the Environmental Division briefs the commander once a month regarding environmental hot topics. The NRM briefs the commander directly about every eight to ten months. The majority of base personnel are aware of the desert tortoise regulations and protection efforts. For example, the Range manager consults with the NRM if and when training activities may directly affect the desert tortoise or its habitat. Unlike most bases, MCLB Barstow has only one Range manager. The natural resources manager has developed a good working relationship with the Range manager and this results in easier communication and improved

problem solving. The presence of the desert tortoise facilitates education, communication, and coordination at Barstow.

MCLB Barstow has completed the final draft of the INRMP. It has been submitted to the U.S. Fish and Wildlife Service and the California Department of Fish and Game for review. Barstow has received input from the state Fish and Game; however, coordination with the USFWS has been a challenge. MCLB Barstow has made every effort to coordinate with USFWS to obtain approval and signing of the INRMP. To date, the USFWS has not responded. Desert management activities can continue at MCLB Barstow without USFWS coordination, but coordination may help to facilitate INRMP implementation. The USFWS could provide valuable input to Barstow with regard to management plans, activities, and techniques.

Participation in the regional desert groups (i.e., DMG, and PACIDERM) helps facilitate components of ecosystem management by requiring participation and increasing awareness for desert management. The managers of the Southern California desert ecosystem are attempting to manage their lands collaboratively and holistically to maintain or restore a self-sustaining ecosystem, regardless of political or administrative boundaries. Partners in this initiative include the Department of the Interior (Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, Geological Survey), Department of Defense (Naval Air Weapons Station, China Lake; Edwards Air Force Base; U.S. Army National Training Center, Fort Irwin; Marine Corps Air Ground Combat Center, Twenty Nine Palms; MCLB Barstow), and State of California (Department of Fish and Game, Department of Parks and Recreation, Department of Transportation). As part of this regional effort, DoD managers are developing a GIS database to facilitate the collection, storage, transfer, sharing, and analysis of information (Mojave Desert Ecosystem Program). Although DoD is the administrator of the database and the database resides in the City of Barstow, Barstow's natural resources program receives no direct benefits. A regional GIS database can be a valuable tool for ecosystem management. However, the natural resources program at MCLB Barstow does not use the GIS database for ecosystem management on the installation.

F. ROBINS AIR FORCE BASE

Installation Background

Robins Air Force Base (AFB) is the home of Warner Robins Air Logistics Center (WR-ALC) and more than sixty other units, including the Air Force Reserve Command Headquarters. The mission of Robins AFB and the WR-ALC is to Keep 'Em Flying.

While the immediate Robins team comprises more than 19,800 civilian, contractor, and military members, Robins is proud of its greater community, so much so that on the front page of its website (www.robins.af.mil), it coins the term "Team Robins Plus," referring to "the remarkable support and friendship we receive from the people of Middle Georgia." Evidence of the weight behind this assertion can be found in the fact that in 1942 the adjacent town of Wellston honored the new base by renaming itself Warner Robins. This enthusiasm could be construed as an example of ecosystem management, in that it emphasizes a regional or community perspective.

Robins AFB is situated on 8,722 acres (of which about 1,700 acres are leased to hunters) and contains more than 14 million square feet of facilities. Robins has the largest runway in Georgia, capable of accommodating the largest aircraft in the world, including the C-5B Galaxy and the NASA Space Shuttle piggybacked on a Boeing 747. It has more than 1,400 family housing units (much of which is outside the main post). Construction began on the new Georgia Air Depot, located 16 miles south of Macon, on 1 September 1941.

Warner Robins Air Logistics Center is one of five such centers in the Air Force, with worldwide management responsibility for the repair, modification, and overhaul of the F-15 Eagle, the C-130 Hercules, the C-141 Starlifter, the C-5 Galaxy and all Air Force helicopters. The center also provides logistical support for all Air Force missiles, vehicles, general-purpose computers, avionics, and electronic systems for most aircraft. Interestingly, Robins AFB was the entity responsible for securing the aircraft stranded in China and returning it safely to the United States. On 1 September 2001, the Center and base celebrated their 60th anniversary.

Bordered by the Ocmulgee River on the east and what was then Wellston, Georgia on the west, the flat former dairy farm tract soon began to be reshaped into what is today the largest industrial complex in Georgia. During World War II, it was renamed seven times and received its current name in 1974.

Robins AFB was buffeted by a major tornado in 1953 and squeezed by growing pains throughout its history. Originally, Robins Field consisted of just over 3,000 acres valued at \$1 million. Today, it is situated on 8,722 acres of an upper coastal plain, of which 2,300 acres are natural wetlands and 1,150 acres are timberlands. There are 180 acres of diversified recreational facilities and a 43-acre Museum of Aviation with ninety historic aircraft on display. Wildlife and vegetation are plentiful and lavish. Birds, alligators, the Florida Panther, and various insects make up the animal population, while magnolias, oaks, and loblolly pines (many planted during the New Deal programs of the 1930s) are

among the wide-ranging species of vegetation. Base staff have uncovered thirty-six archaeological sites.

In 1998, Robins' total economic impact on Middle Georgia was \$3.1 billion. The town of Warner Robins is home to about 52,400 people, while Houston County now numbers nearly 107,000. Other effected towns include Perry, Cochran, Fort Valley, Byron, Macon, Forsyth, Hawkinsville, Eastman, and the other regional towns of Middle Georgia's twenty-five counties have also grown in size and experienced economic stability as a result of the development of Robins AFB.

A Bird-Aircraft Strike Hazard (BASH) program has been initiated to minimize installation impacts on wildlife, including local and migratory birds as well as local deer, hogs, and alligator that occasionally wander onto the runway, causing serious risk to airmen and other personnel. The east side of the runway is currently unfenced, and the other sides have an 8-foot fence. It will cost another \$130,000 to complete this preventative effort. In the meantime, Robins has entered an MOU with the Department of Agriculture through the Corps of Engineers to shoot deer on the air field. More than seventy-five feral hogs have been trapped and shot by volunteer hunters since September, who get to keep the meat. There is a prohibition on transporting the animals live, since they have detrimental effects on native under story vegetation.

About 80 acres of loblolly pine were planted on post in 1980 for commercial purposes, and the first thinning was harvested about 2 years ago. Forestry Reserve Account funds were received as a result. The base approached The Nature Conservancy, Audubon Society, and Trust for Public Land with a proposal for a 25-acre project to restore the long-leaf pine and to initiate some monitoring for RCW habitat, but none were very enthusiastic about the idea because the proposed acreage was so small. Robins AFB sponsored and hosted a recent Air Force-wide workshop on natural resources management on small, urban bases.

Robins staff stress the significance of urban forest management – a different approach than that used at a large base like Eglin in northwest Florida. Wetlands make up about one-third of the base's area and are richly forested with tupelo, sweet gum, green ash, and different kinds of oaks. The upland areas include hardwood bluffs, loblolly pine forests, and a degraded longleaf pine community.

In 1994, natural resources managers inventoried the trees in the urban parts of the base and established a tree management plan containing information on more than 15,000 trees. Snags were left standing where appropriate, or felled and left in place to provide food and homes for wildlife.

The Environmental Management Directorate designed and implemented a GIS that includes internet linkages to enable employees and the local community to make more informed decisions. With information available to the public on the web, technology then provided the means to ask a question and to graphically respond.

The Environmental Management Directorate was the winner of the Best Overall Environmental Quality Program in the DoD in 1994.

Case Study Analysis

Robins Air Force Base is representative of a small base with extensive air support activities in a moderately resilient temporal forest environment with no protected species.

Installation Organization

Middle Georgia was picked for the site of what was to become Robins AFB because it had level land for an airfield and an abundance of water. These were important points to consider in 1941, when emphasis was on speed of construction. In 1988, General Gillis established the Directorate of Environmental Management at Robins AFB. Manpower was realigned among three divisions and placed in functional groupings to deal with existing and emerging environmental issues. The reorganization meant increased status — equal to other functional managers, reporting directly to the Center commander, and aligned so as not to be inhibited in advocating an environmental perspective.

The Facilities and Environment Director reports to the base Vice Commander — a one-star and Chair of the installation's Environmental Protection Committee. It was moved out from under Civil Engineering in 1986 in order to ensure more direct access to senior installation leadership. This is unusual because even the Air Force Headquarters Environmental Office is still under Civil Engineering, whereas Robins is not. The EM Directorate consists of three divisions: Pollution Prevention, Compliance/Restoration, and Environmental Resources.

- Pollution Prevention Division plans and implements Robins AFB strategies to reduce air, land, and water pollution.
- Compliance and Restoration Division ensures the base is in compliance with state and federal environmental regulatory requirements; provides technical oversight to correct discrepancies; and manages the asbestos, lead, drinking water, wastewater, storm water, aboveground and underground storage tank programs, and groundwater and surface water.
- Environmental Resources Division performs management, planning, and programming of the financial, manpower, equipment, and supplies resources for the entire directorate. The Division prepares budget submissions for compliance, restoration, pollution prevention, and industrial funds programs. It is responsible for the Environmental Compliance Assessment Management Program (ECAMP) and the Environmental Impact Analysis Process Program (EIAP), as well as management of cultural and natural resources.

Funding and Staffing

The EM Directorate pays the salaries for two environmental lawyers in the installation legal office. Installation environmental staff reported an increasing workload with respect to reporting requirements, approaching the point where there is more “reporting” than “doing.” A current A-76 study threatens to virtually eliminate government management of natural resources, reducing it to merely an exercise in contract management.

Vision, Goals, and Objectives

An Environmental Protection Committee has representation from all organizations on base. An installation Restoration Advisory Board serves a similar function but also includes representation from off post.

Communication, Coordination, and Partnering

Robins AFB is located in the Ocmulgee/Altamaha/Oconee river basin and has seven discharge points into this system, all on the eastern boundary, which is defined by the Ocmulgee River. There is a lime rock/sand mine to the north, wetlands and timber to the east, low-income housing and the City of Warner Robins to the east. The more affluent neighbors live a short distance to the south but are not completely immune to runway noise. Most new development lies to the southwest. Runway traffic generally goes north to northeast. The nearby Oaky Woods Wildlife Management Area is owned by Weyerhaeuser but managed jointly by the Georgia Department of Natural Resources, where hunting is allowed. The West Tract of the Oaky Woods Area is about 650 acres and is directly adjacent to the northeast corner of the installation. Bond Swamp National Wildlife Refuge is a short drive north; an Environmental Assessment was recently initiated to consider expanding the 6,000-acre Refuge to new property near the Robins boundary. Ocmulgee Wildlife Management Area is also nearby. The Ocmulgee Heritage Greenway, a project of the Trust for Public Land, approaches the southern end of the base. A recent 68-acre land swap enabled development of some Air Force-owned out-parcels into new soldier housing. About 50 percent of the City of Warner Robins either works on the base or has family that works on the base. A little over 1,700 acres of the installation is leased to hunters.

The B-1 bomber is among the loudest aircraft in the Air Force inventory. Eight B-1s are currently stationed at Robins, and more may be on the way. The noise contours for this aircraft go off the installation into the urbanized area of the town of Warner Robins.

Thirteen American Indian tribes are recognized as having interests in the management of Robins AFB. The most active are the Muscogee, Creek, and Porch (Alabama) bands, with interests located in MS, AL, SC, GA, NC, OK, FL, and LA. One tribe was approached for general coordination and declined. There are thirty-nine archeological sites on post. A resource of particular interest to such groups is the collection of medicinal plants; a frustrating but not insurmountable obstacle in this area has been the many different names used by different American Indian groups to describe largely the same plants of interest.

The Sierra Club monitors on-going restoration efforts through its participation on the installation's Restoration Advisory Board. Ducks Unlimited and the Boy Scouts have both initiated projects recently on-post, with ten or eleven Eagle Scout projects in recent memory. Such projects have focused on protecting or studying turtles, birds, and bats, and one project involved sinking Christmas trees in a lake to create attractive fish habitat. Mercer University is not far from the installation, presenting opportunities for partnered research.

A "Fall Line Freeway" has been proposed by the Georgia Department of Transportation to transect the state across the middle, but the exact route has not yet been determined. Since Robins is located right in the middle of the state, the installation is watching developments for potential impacts to regional air quality, air space, and rights-of-way. The quality of the air in the City of Macon, 16 miles to the north, is a growing issue of concern for Robins. The City of Warner Robins recently installed its first air quality monitoring station, and Houston County is one of the top five growth areas in the state. Fine particulate matter (PM 2.5) is a related concern during prescribed burnings, which are conducted only when the wind is blowing west to east, and therefore away from populated areas.

The latest Integrated Natural Resources Management Plan was completed in 1995, and is currently being revised through a contract with USR Grimmel, Inc. The newest version of the draft arrived in the mail while we were on site, and although we thought it inappropriate to ask for a copy to take with us, a quick browse revealed that the Principles of Ecosystem Management, as cited in Leslie (1996), were prominently listed on page 41. A primary goal for the new version is to condense it into a more workable size without losing any relevant information and guidance. An Environmental Assessment as required by NEPA is being prepared separately, on a Programmatic basis. The process for public involvement for this document will be modeled after the recent success of Tinker AFB. The INRMP will have a work plan module tiered off of it to help with budgeting each year. The new INRMP is expected to represent a "shared vision of ecosystem health," insofar as it will be coordinated extensively with the Georgia Department of Natural Resources, the U.S. Fish and Wildlife Service, and The Nature Conservancy. In the 1990s, The Nature Conservancy helped the base identify eight ecotype areas along with a protected species inventory, so some of the groundwork is already laid. A wetland banking program has been envisioned and may begin to unfold soon.

Education and Training

The Environmental Management Directorate maintains an extensive website at www.em.robins.af.mil, and also a site devoted to GIS at www.gis.robins.af.mil, where selected GIS data are made available to the public. Installation environmental staff report minimal installation support for further training. Staff are allowed one training event per year. Recent training by the Georgia Urban Forest Council and The Wildlife Society were offered as examples of good training opportunities. One staff member felt a particular training opportunity was important but could not get installation support, so he used his annual leave to attend.

Installation environmental staff suggested that ecosystem management requires existing staff to have a broader and more diverse skill set than ever before, and more training is needed toward that end. Ecosystem management at a large installation is different than it is at a small one. At least one Robins staff person attended ecosystem management training in 1998, where a keynote speaker was from Eglin AFB, which has 460,000 acres. He found many of the words of wisdom irrelevant to his small base of 8,770 acres. More specialized ecosystem management training is therefore warranted.

Installation staff commented on the numerous reporting systems as a potential source for training. Most of the reporting systems such as ECAS, IQR, USR, etc., are seen by installation staff as largely “info-out” but never “info-in.” That is, they report all this information up the chain, but very little of it is ever sent back down to them in a way that could be useful for them to learn how other installations might be doing things better.

Concluding Remarks

At the conclusion of our meeting, Bob Sargent offered an excellent overview/summary of his perspectives:

- (1) A lack of resources is a persistent problem for natural resources management at Robins AFB, primarily because natural resources management funding is driven mostly by the presence of protected species. Robins has no protected species, but that doesn't mean they don't have statutory and regulatory natural resources management requirements.
- (2) Excessive reporting ties hands and slows down progress on actually “doing.”
- (3) Privatization and A-76 has meant a loss of job security, which translates into weakened morale. A-76 hurts morale. One third of the staff flees; replacements are temps; too much time to justify existence rather than actually working.
- (4) Regulations are becoming increasingly unenforceable due to the lack of funds caused by a lack of endangered species. Unfunded mandates only exacerbate this problem.
- (5) Educating the incoming Base Commander is crucial. Endangered species and wetlands are the only natural resources management issues that can send a Commander to jail, and are therefore the most important issues to get across given limited face time. Ecosystem management has no such “stick,” and therefore there is little knowledge or understanding among Commanders about biodiversity, because it is not likely to be taught in the Commander “charm schools.”
- (6) Urbanization is a problem that can only get worse. Many of our neighbors do not enjoy the same conservation ethic that we do, and we are the ones who suffer from their development.

- (7) Inter-service cooperation is important. We know who our counterparts are in Georgia and the region, but it is an extended peer group at best, and it needs to be stronger.
- (8) Image is just as important as actual good stewardship. We're seen as hunters and loggers by many who live off post, and yet we're seen as tree-huggers by our own soldiers. Our highest and best name should be simply "natural resource managers."

G. NAVAL SUBMARINE BASE KINGS BAY

Installation Background

“We exist to enable war-fighter readiness” is the mission statement of Naval Submarine Base Kings Bay, located adjacent to the town of St. Marys, Georgia and about 35 miles north of Jacksonville, Florida.

Kings Bay is one of the newest installations in the United States. Although initially commissioned in 1978 as a 9,000 acre standby ocean terminal for the Army, it was not until 1982 that the installation was handed over to the Navy to become a 16,225 acre home for Navy submarines. Bangor, Washington, is its West-coast counterpart installation. Construction was initiated and maintained at a fever pitch from 1982 to 1992, staffing as many as 20 Corps of Engineer officers and 189 civilians to administer 101 architect/engineer contracts and 383 construction contracts, spending more than \$1 million per day at its peak in 1987.

The first Trident submarine arrived in 1989, and the last of ten arrived in 1997. The facility is still so new that eight of the original staff remain on post to wrap up final details of the initial design/build phase. Construction of Naval Submarine Base Kings Bay was the largest peacetime construction program ever undertaken by the US Navy. The Trident Training Facility is the largest building in Camden County, and the Trident Refit Facility has the largest covered dry dock in the Western hemisphere.

Personnel number more than 9,000, including 5,500 military, 2,200 civilian, and 1,300 contract staff with a total payroll of \$227.6 million. There are twelve additional tenants. Camden County, where Kings Bay is located, is the fastest growing county in Georgia and the third fastest growing county in the nation. It has grown from 12,000 people in 1978 to more than 40,000 in 1997.

Naval Submarine Base Kings Bay is home to 229 species of birds, 68 mammals, 67 reptiles (including 5 poisonous snakes), and 37 amphibians. Twenty of these species are threatened or endangered, including marine mammals such as the Manatee and the Right Whale and terrestrial species such as the gopher tortoise and possibly the indigo snake. At any given time, there are about ten to twelve Manatee on post. The Manatee and Right Whale are of particular interest to installation managers because they are wont to occupy some of the same places where submarines enter and exit the facility. This dredged channel is 25 miles long, 50 feet deep, and 100 feet wide at low tide, leaving only 5 feet of clearance on either side of the vessel. Dredging is conducted by the Corps of Engineers through the Section 404 process. Another success story relates to Least Terns. Facilities personnel were repairing an HVAC unit on a rooftop when they discovered numerous Least Terns nesting in the loose gravel on the rooftop. Apparently, Terns took a liking to the particular size and color of the stones, and found the rooftop location a good distance from other predators. Now many buildings on base are covered with this same material to encourage them. Similarly, Tern habitat was

improved when the installation switched from using Round-Up to using ordinary salt water for removing weeds from sand piles.

Of the base's 16,225 acres, about 4,000 are protected wetlands. About 6,000 acres are managed for commercial timber and 4,000 acres for non-commercial forest resources. About 9,800 acres are covered by the installation natural resources management plan, and the rest is considered cantonment area. There are no out-parcels. The Explosive Safety Quantity Distance extends beyond the installation boundary and onto the Cumberland Island National Seashore. Roughly 829,000 gallons of water per day are treated at Kings Bay's waterfront wastewater treatment plant and at the Land Application System wastewater treatment plant.

A significant portion of the Kings Bay landscape is defined by enormous dredge spoil piles – artificial reservoirs defined by 50-foot high levees that can be pumped full of liquid dredge material and then left to evaporate, leaving a new layer of sand at the bottom. Most of these facilities will be completely filled by 2030, leaving behind several hundred acres of level earth at an altitude just above the treetops. Potential military and/or civilian uses for these soon-to-be high-and-dry lands have not yet been identified. Research at ERDC (WES or CERL) may help uncover potential uses.

Boats, canoes, tents, campers, cots, sleeping bags, lanterns, rods and reels, bicycles, log splitters, and gas cans are among the most requested equipment at the Morale, Welfare, and Recreation Department. Picnic areas with tables and grills are located at Etowah Park, Lake D, and "Under the Pines" areas. Covered pavilions, volleyball courts, horseshoe pits, children's playground area, and a boat dock are accessible.

Federal facilities are exempt from the Coastal Zone Management Act, but Kings Bay complies voluntarily.

Case Study Analysis

Naval Submarine Base Kings Bay is representative of a small base with extensive submarine support activities in a sensitive coastal environment with twenty protected species, two of which are marine mammals.

Installation Organization

The Facilities and Environment Division is commanded by an O-6, employs about 220 people, and reports to the Commanding Officer of the installation. The Environmental Branch has a staff of fourteen and is lead by a GS-13. The Natural Resources Management Office has a staff of three and is directed by a GS-12. The NR staff consists of a wildlife biologist (GS-11) and a forestry technician (GS-7). The Facilities and Environment Division receives technical advice and oversight from the Naval Facilities and Engineering Command in Washington, DC.

Funding and Staffing

About \$100,000 or 75 percent of the Natural Resources Management Office is funded through non-appropriated funds generated from commercial forestry. About \$150,000 went to local schools last year, but that was a high year, since only about \$450,000 has gone to local schools in the history of the base. There are no agricultural leases, although in the past there was a small apicultural (bee honey) operation.

Vision, Goals, and Objectives

Part of the installation's vision is to be the Navy's leader in innovative shore installation management, with the community viewing the installation as an essential part of their own successes. Guiding Principle #7 for Kings Bay is to be caretakers of installation resources, promoting partnerships within the community to assist in realizing installation goals.

Some installation goals for natural resource management are set at the regional level through an INRMP. The last INRMP was completed 11 years ago, and is currently under revision. The Environmental Assessment, required for the plan by the National Environmental Policy Act, is available in the local library. The comment period recently ended, and there were no comments received. The plan was contracted-out to Gene Stillman of Ecology and Environment, Inc., from Tallahassee, Florida. The South Division of the Naval Facilities Engineering Command (SouthDiv: NAVFACENGCOM) is leading INRMP preparation by using the same statement of work for all plans in the region. This helps with consistency and also with encouraging a regional perspective. Similarly, protection of the Right Whale is managed regionally by Jerry Walmejer at the Navy Regional Environmental Office.

Communication, Coordination, and Partnering

Kings Bay shares a fence to the north with Crooked River State Park, and the Cumberland Island National Seashore lies immediately across a channel to the east. The City of St. Mary's, Georgia, is the nearest town to the south, and 4 miles south and just beyond the town lies the St. Mary's River, which forms the border between Georgia and Florida. The river may soon be designated Wild and Scenic, which may present opportunities for cooperation on protection of the Manatee. To the west are private lands, managed mostly by Rainer, Inc. for timber production and industrial purposes. Prescribed burns for timber management are rare on Kings Bay, but when employed they are only done when the winds are to the northeast, thereby drifting the smoke onto other timber lands rather than recreational or municipal land uses. A municipal airport to the southeast flies directly over the missile storage area, which has been a source of controversy for some time.

Regional partnerships include an agreement with the Tampa Zoo, funded by the DoD Legacy Program through the Corps of Engineers, to better understand the hearing range of protected marine mammals and to create a "marine deer siren" of sorts to warn Manatees that a vessel is approaching. A similar agreement with Valdosta State

University is focused on human-made wetlands and salt marsh research. One project that has proven highly effective relates to the installation of protective grates over the 6-foot diameter propellers on Trident tugboats. In addition to succeeding in their protecting objective, the grates had the unanticipated benefit of reducing an unrelated vibration problem on the boats, while increasing drag only slightly. The Georgia Conservancy, the Audubon Society, and the Girl and Boy Scouts have all made recent field trips to Kings Bay.

According to installation environmental staff, there are technically no American Indian tribes that have “a controlling interest” in installation activities, although the Creek Nation and many others may elect to exert influence in the future. In the 1970s, the Creek Nation claimed rights to an installation island called Drum Point, but the Corps of Engineers proved the island consisted entirely of dredge spoil, and therefore did not exist prior to Western settlement.

Installation environmental staff report that ecosystem management is not a common topic of interest among citizens in the region; rather, they often call to express concern over management practices concerning specific, individual resources.

In recommending Kings Bay as a case study site, Navy Regional Coordinator Jerry Walmejer made a point of emphasizing the success of the Weekend for Wildlife program of the Georgia Department of Natural Resources (DNR), which has enjoyed particular success at Kings Bay. At a recent fundraising event for the program, about forty people representing corporate sponsors paid \$15,000 for a sponsorship or \$1,000 per plate for a benefit dinner and walking tour of the natural resources on the installation. The program proceeds will benefit state management of non-game species, both on and off post throughout the state. The Georgia DNR is thrilled with the success of the program and plans for similar events in the future.

Education and Training

Incoming installation personnel receive environmental overview information from the Kings Bay Indoctrination Division. About half an hour of the two-day course is devoted to the full range of environmental issues from hazardous materials to natural resources. Installation environmental staff interviewed expressed an interest in receiving more training in the principles and tenets of ecosystem management. Some staff attended a recent workshop on regional natural resources management at the University of Georgia School of Forestry. It has proven difficult to get installation support for hiring a part-time student aid through the Student Conservation Association. These positions usually involve no pay but free room/board for six months at a time. A lack of opportunity for advancement was one personnel issue identified as detracting from achievement of ecosystem management principles, while a sense of professionalism and personal job satisfaction were cited as reasons for staying involved. Installation environmental staff expressed frustration when presented with the list of ecosystem management principles, saying they needed something more like a cookbook – something less esoteric. In going over the list of principles, the general response was that ecosystem management principles are just good common sense (or at least a sort

of professional common sense) and generally the principles represent basic standard operating procedures.

H. MARINE CORPS BASE QUANTICO

Installation Background

The history of Marine Corps Base Quantico (Quantico) began when the then-Major General Commandant was considering the Washington D.C. vicinity as a location for a new Marine Corps base. After reviewing possible sites, the Marine Barracks Quantico was established in 1917. The base, located about 35 miles south of Washington, D.C. in Prince William County, Virginia, covers 60,079 acres. Most of the installation is forested but surrounded by an increasingly suburban setting.

Quantico's mission is to train Marines. By 1920, the Marine Corps schools were established at Quantico. These schools eventually developed into today's Marine Corps University, where Marine officers begin their careers at the Marines Officer Candidate School and where many enlisted Marines keep up with their primary military education. The Marine Corps first helicopter squadron - Marine Helicopter Squadron One (HMX-1) - was established at Quantico. HMX-1 was the first helicopter squadron to provide rapid transportation of U.S. presidents and it continues that mission today. In 1934, Amphibious Warfare Doctrine, along with special amphibious landing crafts for WWII, were also developed at Quantico. Quantico trained and prepared Marines for deployment to Europe for both World Wars.

The base's Natural Resources and Environmental Affairs (NREA) Branch has primary responsibility for overseeing implementation of ecosystem management on Quantico. This is accomplished mostly through the Branch's seven sections, with the forestry, wildlife, fish and agronomy, and NEPA sections having the lead responsibility. The NREA currently has a staff of approximately 40 to 45 peoples depending on the season.

Of the 60, 079 base acreage, 53,066 acres are forested lands; 5,644 acres are non-forested uplands; and 1,369 acres are non-forested wetlands. Improved lands (i.e., buildings, highly maintained landscapes, etc.) make up 2,611 acres of the non-forested uplands. Quantico is also on the National Register of Historic Places. Also, the base has been placed on the National Priority List.

Case Study Analysis

Quantico is a large forested base. With the exception of Prince William National Forest to the north, it is becoming surrounded on all sides by urban and suburban development. Currently, the base is home to six federally and/or state listed threatened or endangered species, including mammals, birds, plants, and a mussel.

Visions, Goals, and Objectives

At the time of the site visit, the INRMP was in the final stages of completion. Specific goals and objectives have been identified in the INRMP. For example, Quantico has objectives to preserve, develop, and manage land and water resources; enhance the

preservation of all animal and plant life; and preserve and develop an outdoor recreation program.

Currently, there is no regional vision for the area surrounding Quantico. Quantico natural resources staff has found it difficult to work at a regional level because of a lack of local community interest in such a regional vision. This has made it difficult to identify an appropriate regional vision of ecosystem management. Encroachment of urban and suburban development has increased over the years. There are concerns within the Quantico natural resources program that this encroachment may eventually put Quantico in the position of being one of the few remaining areas of undeveloped land in the region. This would further impede Quantico's ability to manage at a regional level.

Organizational Challenge

The NREA Branch is located under the Facilities Division of the installation organizational structure. The NREA is divided into seven sections—Wildlife, Fish and Agronomy; Forestry; NEPA Coordination; Installation Restoration Program; Environmental Law Enforcement; Environmental Affairs; and Environmental Engineering. The overall NREA is comprised of forty to forty-five employees. The sections involved in natural resources management (Wildlife, Fish and Agronomy; NEPA Coordination; Forestry; Environmental Law Enforcement; and the Installation Restoration Program) include about sixteen staff members. The natural resources management staff is often augmented with seasonal staff.

The head of the NREA has a direct line through the director of Facilities Division to the base commander and meets with the Facilities Division director once a week. This line of communication has been crucial in managing the entire NREA. The head of the NREA Branch then meets with his staff members at least once every two weeks. Although the natural resources staff does not consistently meet with the commander, the head of the NREA Branch occasionally informs the commander of natural resources issues, accomplishments, and needs.

Funding and Staffing

Quantico NREA Branch has been successful in acquiring volunteers and using a variety funding sources to partially supplement funds and staff levels.

Most funding granted to the NREA Branch at Quantico is for compliance-related projects — projects that are required by law and that could result in legal action if Quantico fails to comply. Many ecosystem management projects are not compliance related and therefore, may not receive funding. Non-compliance projects may be delayed or cancelled because there are not enough funds to support the requirements of the DoD's ecosystem management policy.

Staffing levels are also affected by funding limitations and base personnel ceilings. Currently, the NREA Branch has about forty to forty-five full-time civilian and military employees (some are seasonal staff). However, the NREA is often subjected to personnel cutbacks and recently lost two full-time positions. The regionalization by DoD

of the Civilian Personnel Office has resulted in hiring delays. Quantico staff may wait up to a year to fill positions as a result. Only sixteen NREA staff support the sections that perform natural resources management and enforcement. Seasonal employees are hired on an as needed basis. Lack of staff support for the natural resources program limits the abilities of the natural resources staff to perform ecosystem management and to implement specific projects.

Communication, Coordination, and Partnering

In general, the natural resources program and ecosystem management are poorly understood on base because of overriding concerns for the military mission. However, the natural resources staff is attempting to increase on- and off-base understanding for the natural resources goals and objectives as outlined in the INRMP by developing an education pamphlet.

According to the NREA Branch head, communication directly between the Commander and the NREA Branch head is adequate. Through this line of communication, the head relays information to and from the natural resources staff.

The natural resource staff communicates with the Range staff frequently. For example, information on training needs and natural resources schedules are coordinated between the natural resources and the Range staff. Geographic Information Systems is one tool that is used to communicate and share information with on-base groups. Many other groups on base make requests for GIS data. The Public Works Branch can download digital data by accessing the natural resources' GIS system through Quantico's server. Public Works uses this data in a CADD system for such reasons as updating the Master Plan. Other groups do not have a comparable system to either the GIS or CADD.

The natural resources staff has good relations with local government agency groups such as the Regional U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries. The Quantico staff coordinates with these groups on a variety of projects and issues.

Partnerships are an essential component of successful ecosystem management. However, the natural resources staff finds little interest for off-base community partnerships. Apart from partnerships with other government agencies, the natural resources staff has not forged many partnerships off base. For the most part, this is a result of a lack of community interest. One reason for the lack of interest is an expressed satisfaction with Quantico's management of its natural resources. As mentioned earlier, there are no local initiatives to develop a regional vision and Quantico natural resources staff have found it difficult to find partners except for specific projects. Quantico has the assistance of over 100 volunteers in the natural resources program, but most of these are drawn from the on-base and near-base communities.

Education and Training

To the benefit of the program, the natural resources staff is knowledgeable and well-trained in the fields of ecology and natural resources management. Training requests for the natural resources staff are well supported. Much effort is made by the natural resources staff to remain up-to-date on techniques and management regimes. Quantico natural resources staff also participate in regional workshops and conferences (DoD's forestry workshop, The Wildlife Society meetings, etc.).